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ORIGINAL ARTICLES.

SPLENIC ANEMIA, SPLENECTOMY, AND RECOVERY.[1]

WITH STUDIES OF THE BLOOD COVERING A PERIOD OF SEVEN YEARS.

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The fact that the patient, whose case I report herewith, has been subjected to a careful study for a long period of time, four years before and three years following the operation of splenectomy, makes the case worthy of record. During this whole period of seven years a large number of blood examinations have been made most accurately for me by one man, Dr. W. Estell Lee, chief resident physician of the Pennsylvania Hospital, Philadelphia, to whom I wish to give credit. The question of the personal equation, which often interferes with the accuracy of work, is thus reduced to a minimum.

J. M., a male, was seventeen years of age at the time of operation in 1904. He had been under my professional care since infancy, but came under particular observation in 1900 at which time the first enlargement of the spleen was detected. Shortly after his birth, which was a most difficult one, his mother was found to be suffering from nephritis, which had affected other members of her family. Some years later, after another pregnancy, she died uremic. The patient's father is of a very nervous temperament, but otherwise healthy. At the age of two years, the patient was enormously fat, but seemed to be perfectly healthy. His family was living near the

[1] Read at a meeting of the Association of American Physicians, Washington, D. C., May 12 and 13, 1908.

Schuylkill River in a somewhat malarial neighborhood, and the child had several attacks of indisposition with fever, during which the probability of malaria was considered, but at no time could the plasmodium be discovered in his blood. In 1900, when thirteen years of age, he was found wanting in tone and quite pallid, with a decided bronchitis. Examination of his spleen showed it to be slightly enlarged. Quinine, iron, and arsenic were administered with apparent benefit.

In March, 1901, an examination of his blood showed 5,260,000 red cells, 5460 leukocytes, and 74 per cent. of hemoglobin. No plasmodia were discovered; there was marked poikilocytosis. The organs of the chest and abdomen appeared normal. The boy was a very large eater, with constipation alternating with diarrhœa. His abdomen was large, and had always been so, and he had occasional attacks of indigestion. At this time, curiously, no enlargement of the spleen could be detected, although palpation and percussion caused pain.

In May, 1902, an examination of his blood showed red blood cells, 4,688,000; leukocytes, 8000, and hemoglobin, 69 per cent. No malarial organisms were found, and the poikilocytosis, though slight, persisted. In October of this year, after a summer holiday at Digby, Nova Scotia, his spleen was found to be enormously enlarged, extending two and one-half inches below the lower border of the ribs. His blood showed red cells, 5,400,000; leukocytes, 4800, and hemoglobin 72 per cent. He looked quite pale, was languid and disinclined to play, and his bowels were capricious. He was growing considerably taller and heavier, but not keeping up his strength. His weight was ninety-six and three-quarter pounds. By the spring of 1903 he had made a decided improvement. His red cells were 5,420,000, his leukocytes 6200, and his hemoglobin 84 per cent; all poikilocytosis had disappeared. His color was better and the spleen appeared to have diminished in size and was absolutely painless to percussion and palpation.

In the autumn of 1903 he returned from Europe looking well. While there, several physicians were consulted, but no light was shed upon the diagnosis or treatment. He now weighed 111 pounds, which rapidly, on his return, increased to 119½. The splenic area remained the same. Notwithstanding his improved appearance, his red cells had fallen to 4,340,000, and his hemoglobin to 69 per cent.

By the spring of 1904 his appearance had further improved, his red cells had risen to 5,020,000, and his hemoglobin to 90 per cent. He still was given to overeating, ate too fast, and as a consequence suffered from occasional indigestion.

On the night of May 22, 1904, after an unusually hearty meal, he felt nauseated and vomited a little blood, but there was no melena or diarrhœa. In the morning he felt sufficiently well to go to school.

On the morning of the 25th he awoke feeling oppressed, but

not nauseated, and had an explosive attack of vomiting of blood; the amount vomited was very large, one of the family remarking that the bathroom looked like a "shambles." During the day this vomiting of blood was twice repeated, and later in the day he had a large tarry evacuation.

When seen in the evening he was ghastly pale and had very violent pain to the right of the ensiform cartilage, about over the notch of the liver. His abdomen was distended, but there was no rigidity of the recti muscles. Palpation over the region of the gall-bladder elicited decided pain. The stomach was greatly distended, the greater curvature extending nearly to the horizontal line of the navel.

FIG. 1

FIG. 2

FIGS. 1 and 2.—Area of splenic dulness as marked on the patient shortly before operation.

His temperature was 102° F. During the night he had two large tarry evacuations. He was at once removed to the Pennsylvania Hospital, where he had, during the next night, several bloody evacuations. His hemoglobin was now only 30 per cent. and his red cells 2,200,000. By the next morning his temperature had returned to normal and his stomach had returned to its normal position. The area of the splenic dulness had decreased decidedly (Figs. 1, 2, and 3). On the 26th the hemoglobin had fallen to 25 per cent., and brighter blood began to be passed with the stools.

On account of the previous symptoms pointing to gastric indigestion and the continuance of the bleeding from the bowel, the question of gastric or duodenal ulcer was considered. A consultation was

held with Drs. LeConte and Harte, and the operation of posterior gastro-enterostomy was decided upon and performed by Dr. Harte. During the operation no sign of ulcer was detected either in the stomach or bowel. The patient rallied slowly from the operation, during which two quarts of normal salt were used by transfusion.

During the next two days he had fourteen bloody evacuations, losing in all thirty-six ounces of blood, but by the 29th practically all bleeding had ceased. On May 31 and June 1 his hemoglobin percentage was only 18.

He made an uneventful recovery from the gastro-enterostomy, all stitches being removed by the end of the second week, at which time

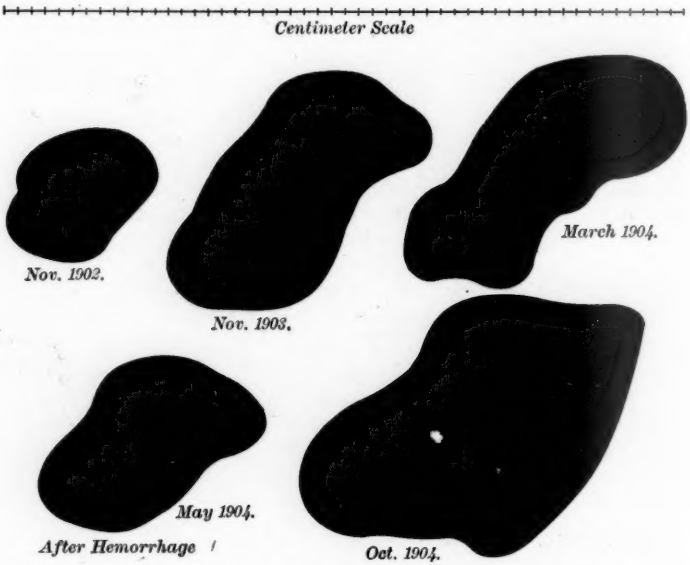


FIG. 3.—Variations in the size of spleen as shown by percussion and palpation.

his spleen was found to extend three inches below the margin of the ribs in the midaxillary line.

Shortly after this his liver enlarged decidedly, his abdomen became distended, and considerable ascites appeared. His evacuations were now frequent and liquid, but not bloody. By July 12 he was considered to have improved sufficiently to be sent to Atlantic City to recuperate. Occasional bloody streaks appeared in his evacuations until the middle of August. By September he was feeling well, had a good appetite and no trouble with digestion, and was able to walk without fatigue. His hemoglobin was 52 per cent., his red cells numbered 3,400,000 and showed slight poikilocytosis,

and his leukocytes were 4200. By October, 1904, his spleen had increased much in size (Fig. 3). He had gained four pounds in weight and his blood had improved slightly, showing a hemoglobin percentage of 54, and a red cell count of 4,200,000. He was having, on an average, six bowel movements, slightly streaked with blood, every day, but no true hemorrhage. The large spleen appeared to be freely movable, and examination of the other organs was negative.

He was again admitted into the Pennsylvania Hospital, and the operation of splenectomy was decided upon. The patient felt no inconvenience at any time from the previous operation of gastro-enterostomy, although in the light of the further study of the case and the diagnosis of chronic splenic anemia, which it was feared was in the terminal stage, or Banti's disease, we regretted having performed it. It is true the hemorrhage lessened after the operation, and the thought has since arisen whether possibly the adhesions which must have formed had not really had the effect of an accidental Talma's operation, forming an anastomosis between the internal veins and those of the abdominal wall, thus relieving the venous congestion and really improving his condition. This result occurred after gastro-enterostomy in a case of profuse gastric hemorrhage seen by me in consultation with Dr. Wm. J. Taylor, of Philadelphia, and later reported by him.[2] Could it be possible that the lessened motions of the stomach, consequent upon the operation, had been effective in diminishing the venous oozing? for after the fourth day very little blood was passed by the bowel.

The operation of splenectomy was performed by Dr. Harte on October 14, 1904. The spleen was found tightly adherent. Silk ligatures were used for the many adhesions and for the splenic vessels. Gauze drainage was used.

This case, although not heretofore reported by Dr. Harte or myself, has been listed as a successful case of splenectomy by Dr. G. E. Armstrong,[3] of Montreal, Canada, and also by Dr. Gaston Torrance,[4] of Birmingham, Alabama. This fact is referred to here for accuracy, in order that it may be seen that these two reports and mine all refer to one and the same case.

The patient reacted fairly comfortably, but in six days a slight pleural effusion, with impairment of expansion of the posterior portions of the left lung, was discovered. A week later pericarditis supervened, but from this and the pleural effusion, and from a secondary abscess in the wound, which was opened on September 9, and from which three ounces of pus was discharged, he recovered perfectly. A sinus remained for weeks subsequently, and all the silk

[2] Trans. Coll. of Phys., Philadelphia, 1906.
[3] Brit. Med. Jour., November 10, 1906, Case No. 25.
[4] Charlotte (Alabama) Medical Journal, 1907, Case XXXI.

sutures were discharged one by one until 23 were collected, when the sinus closed entirely (the end of October, 1905), and has since given no trouble. At this time he looked well, weighed 126 pounds (clothed), had a good appetite, and never felt better in his life. He was able to take exercise freely without any sense of strain.

By the next year he again had some sense of indigestion, which was undoubtedly due to indiscretions in diet. At no time has there been any pigmentation of the skin or enlargement of the thyroid or of the lymphatic glands. The patient now, in 1908, seems to be in perfect health, although, as might be expected, indiscretion in diet causes some distress and diarrhœa. He weighs over 130 pounds, he is very active, and takes exercise, swimming, etc., with perfect comfort. He has had no further hemorrhage.

As a proof of his occasional indiscretion in diet, he has been known, since the operation, to eat, on a wager, twelve ears of corn at one sitting, and not suffer seriously in consequence, except for a diarrhœa which yielded to appropriate treatment. An inveterate acne vulgaris appeared shortly after the operation and still remains, notwithtanding all efforts to relieve it.

The blood charts (Figs. 4, 5, and 6) show: (1) The percentage of hemoglobin, and the red blood cells per cubic millimeter from March 16, 1901, to February 20, 1908. (2) The total leukocyte count for the same period; and the polymorphonuclear leukocytes, the large mononuclear leukocytes, and the lymphocytes, all per cubic millimeter, for two periods: May 5, 1904, to July 22, 1904, and from October 14, 1904, to February 20, 1908. (3) The eosinophiles and basophiles per cubic millimeter also for two periods: May 28, 1904, to July 22, 1904 (the gastro-enterostomy period), and from October 14, 1904 (the splenectomy period), to February 20, 1908.

The continuous tracings on the charts represent the period when but a day or so elapsed between the examinations, while the isolated records represent the examinations which have been made at considerably longer intervals. To join both of these records with a continuous tracing would give an erroneous impression as to time relationship. The total number of the elements of the blood have been calculated for each cubic millimeter rather than recording the percentages.

In examining Fig. 4, it is seen how profuse the hemorrhage was, as the hemoglobin fell from 90 per cent., where it was but a short time before the loss of blood, to 18 per cent., which low point was reached a few days subsequently; this and the subsequent rise to health is represented by the continuous line and by the isolated records. The broken line shows the red blood cells per cubic millimeter.

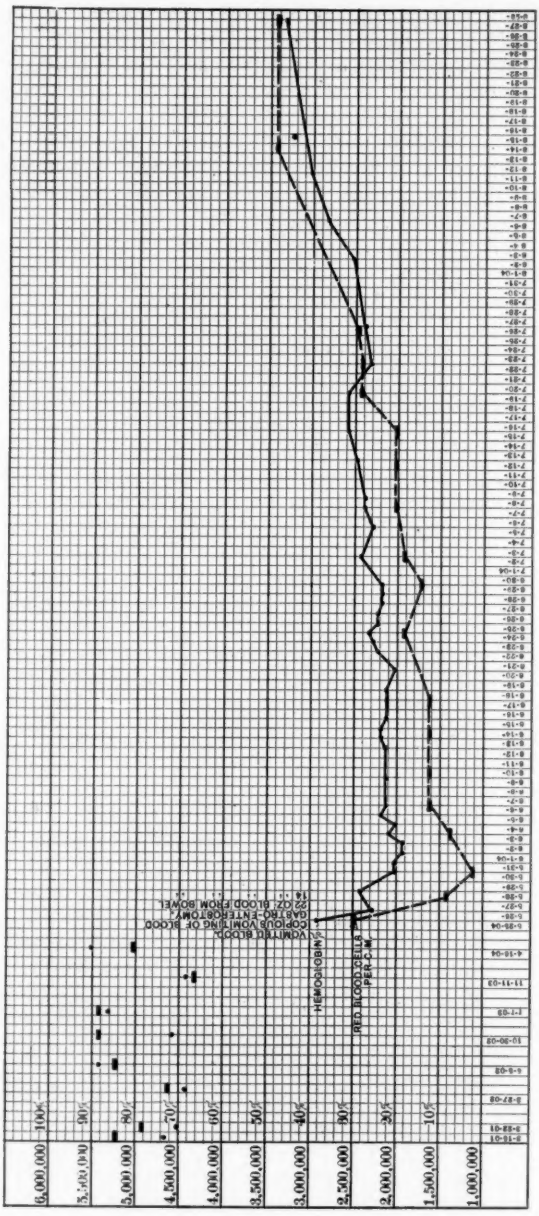
In Fig. 5 two periods of leukocytosis are seen, the first being a posthemorrhagic leukocytosis in May, 1904, and the second period

corresponding with the time of removal of the spleen. A rapid rise to over 10,000 per cubic millimeter occurred in three days, this rise being evidently largely due to the inflammatory complications which followed the operation: pleural effusion, pericarditis, and the abscess in the wound; this continued until 24,000 leukocytes per cubic millimeter was reached, after which the count rapidly fell, so that within one month after the operation it averaged 10,000 per cubic millimeter; this average has remained until the present time, considerably higher than it was before the violent vomiting of blood at which time the count averaged about 6000 per cubic millimeter, and very much higher than the low quiescent period, between the two operations, when it averaged 4000 per cubic millimeter. As all apparent cause of leukocytosis is absent, unless it might be the pronounced acne, it is difficult to disassociate it from the removal of the spleen and the consequent compensatory reaction of the bone marrow. Ehrlich and others distinctly assert that leukocytosis is purely a function of the bone marrow. The polymorphonuclear count follows very closely in character the tracing of the total leukocytes, and shows a marked increase over normal immediately after the splenectomy period and during the subsequent inflammatory complications, but it soon falls to normal. The lymphocytes show a moderate irregular rise at two periods: at two weeks and at one and a half years after the removal of the spleen, and even here the normal count of from 20 to 25 per cent. of the total leukocytes was barely reached.

Fig. 6 is most interesting and shows the marked eosinophilia which occurred immediately after the splenectomy. The large number of eosinophile records which were made previous to the operation also renders this chart valuable, as in most cases of splenectomy but few records have been taken previous to the operation. This absence of pre-operative eosinophilia rather points to the fact that the functions of the spleen were not entirely abrogated by disease, else according to Kurloff's law of the secondary reaction of the bone marrow, they would have been increased.

During June and July the eosinophile count varied from 10 to 100 per cubic millimeter, with an average of 50, during which time the total leukocyte count fell from 16,600 to 1200 per cubic millimeter. There is but little change in the eosinophile count for this period, but if the total leukocyte count is examined it will be seen that a very great change in the percentage of the former occurs.

The method of tabulating the actual count of the blood elements per cubic millimeter is preferable to registering the percentage, as the latter, as has just been stated, may change decidedly without correspondingly altering the actual count. The high eosinophile record of 1800, on October 31, 1904, out of a total leukocyte count of 16,000 is only equivalent to 11.2 per cent., while the much lower records of 630 eosinophiles, on November 3, 1904, out of a to al leukocyte


HEMOGLOBIN %
RED BLOOD CELLS PER C.M.
VOMITED BLOOD.
COPIOUS VOMITING OF BLOOD
CHLOROFORM ANESTHETIC
22 OZ. BLOOD FROM BOWEL
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
6,000,000
5,500,000
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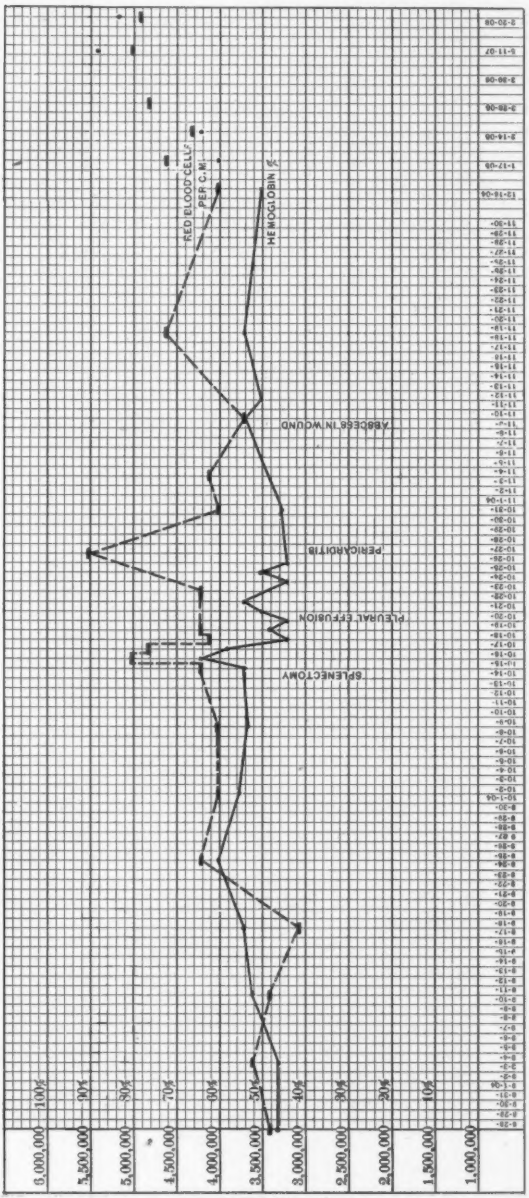
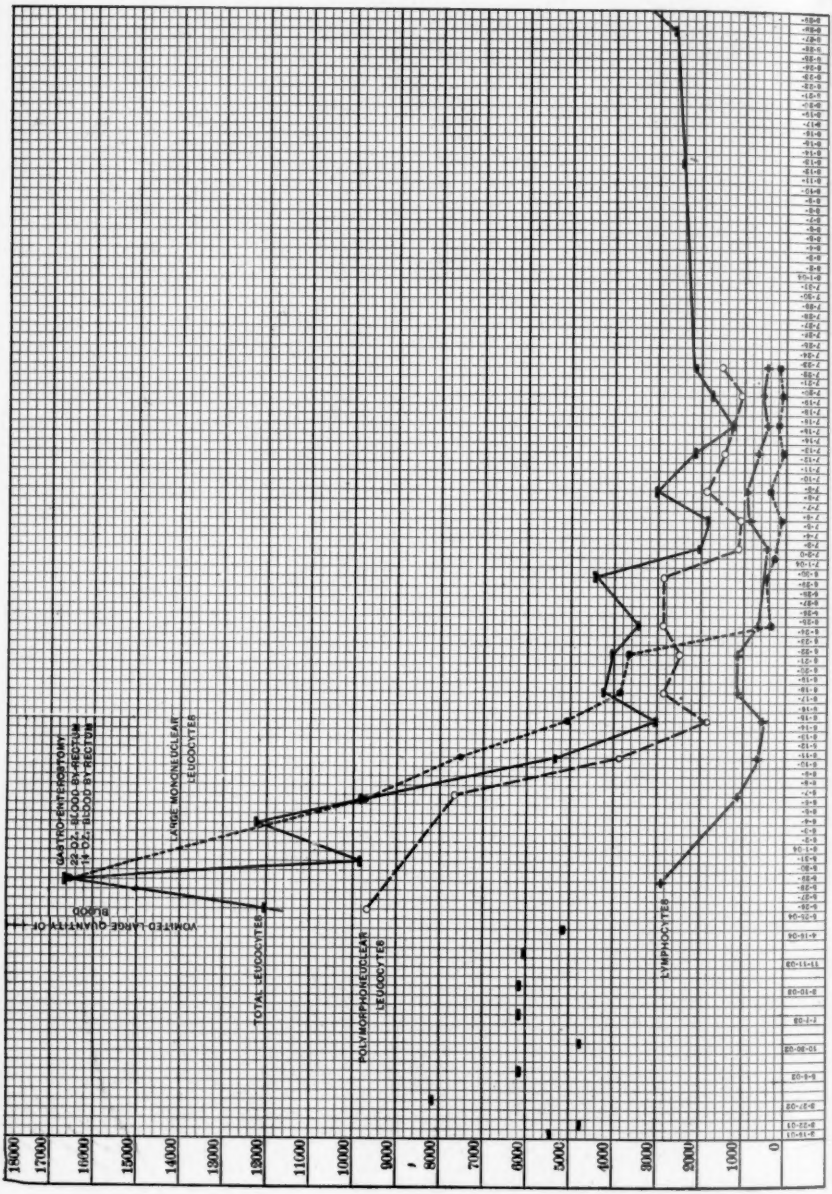


FIG. 4.—Percentage of hemoglobin and the red-blood cells per cubic millimeter, from March 16, 1901, to February 20, 1908.


GASTROENTEROSTOMY
22 OZ. BLOOD BY REC TUM
19 OZ. BLOOD BY RECTUM
VOMITED LARGE QUANTITY OF BLOOD
LARGE MONONUCLEAR LEUCOCYTES
TOTAL LEUCOCYTES
POLYMORPHONUCLEAR LEUCOCYTES
LYMPHOCYTES
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
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4000
3000
2000
1000
0

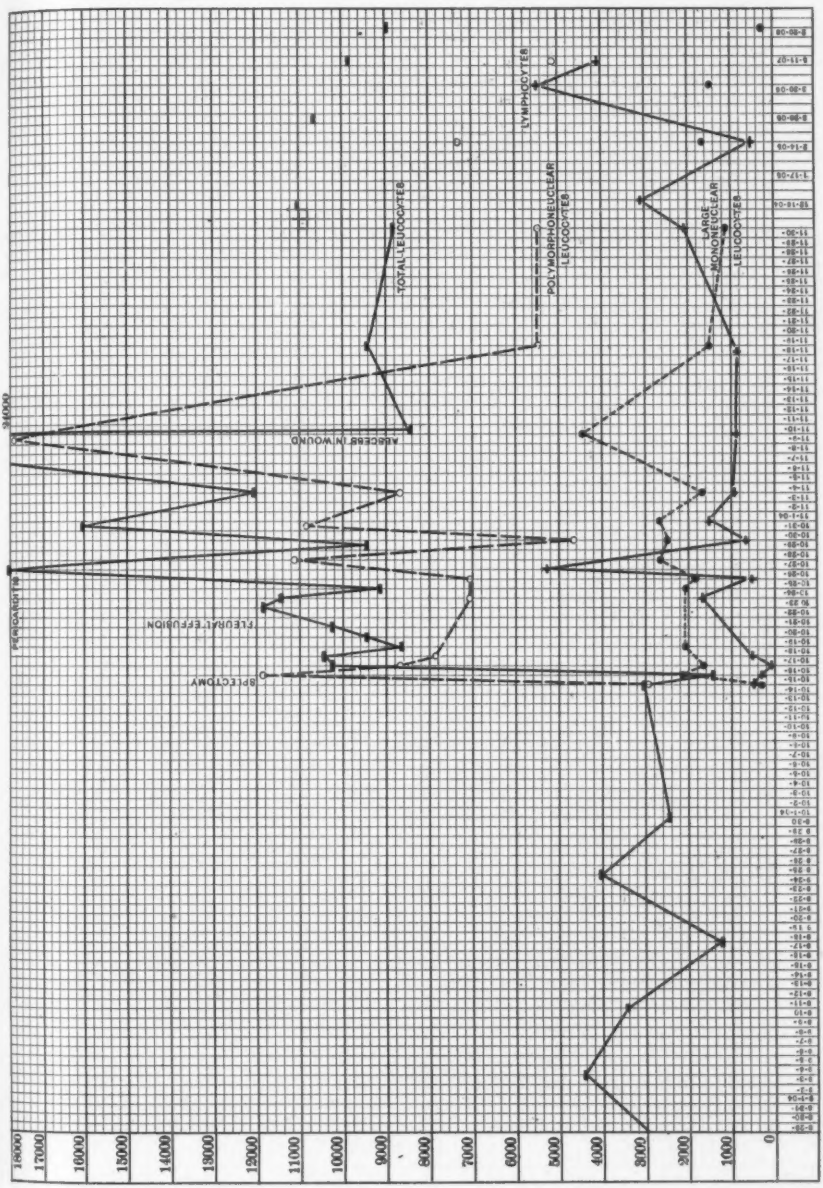

FIG. 5.—Total leukocytes, polymorphonuclear leukocytes, large mononuclear leukocytes, and lymphocytes per cubic millimeter, at the dates indicated on the margin.

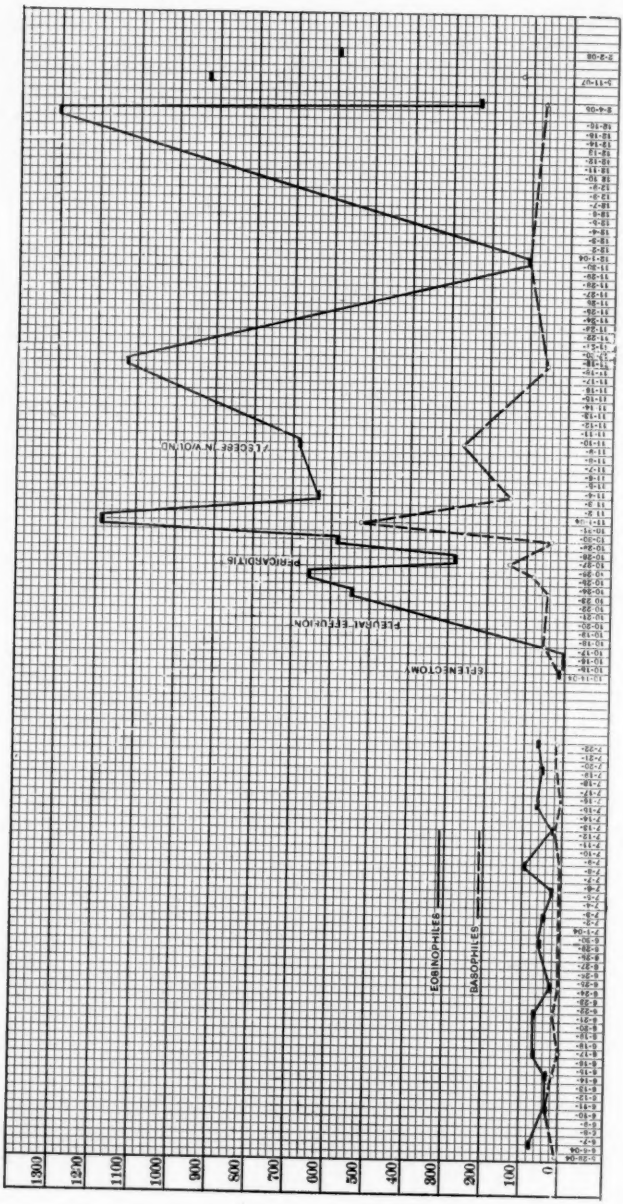

FIG. 6.—Eosinophiles and basophiles per cubic millimeter, at the dates indicated on the margin.

count of 13,000, and of 670 on November 8, 1904, out of a total leukocyte count of 24,000, represents 4.8 per cent. and 2.8 per cent., respectively, which would lead one to an erroneous opinion as to their actual numbers. Two depressions in the tracing correspond to the time of the pericarditis and the abscess formation. The two very low points, 100 and 203, respectively, per cubic millimeter, do not correspond with any recognizable changes in the patient's physical condition, nor with anything unusual in the tracings on the other charts.

The sudden postoperative eosinophilia does not agree with the statements of Kurloff, or of Hartmann and Vaquez, who state that eosinophilia is a late manifestation after this operation, and is due, as previously stated, to the secondary reaction of the bone marrow, the so-called compensatory eosinophilia.

In the case of splenectomy reported by Stengel[5] 7.8 per cent. of eosinophiles were found on the day before the operation, but as he neither mentions the number per cubic millimeter nor the total number of leukocytes, the record cannot be compared with my tracing. It is, however, a positive eosinophilia antedating the operation. An immediate drop to 0.2 per cent. occurred, and then a rise on the fourth day to 10.5 per cent., or a total of 1335 per cubic millimeter; but in this case, as in mine, the record was probably modified by a serious postoperative complication; in Stengel's case, pneumonia.

Kurloff, in his studies on splenectomized guinea-pigs, quoted by Ehrlich, reaches the conclusion that a lymphocytosis "occurs so constantly in the course of the first year after the operation as to constitute a characteristic of the absence of the spleen," and that this lymphocytosis "in the majority of cases retrogrades during the course of the first year even to a condition in which a less number of lymphocytes than normal is produced." This condition does not obtain in the present case, as may be seen in Chart II; neither did it occur in Stengel's case.

Hartmann and Vaquez, quoted by Ehrlich, conclude that splenectomy causes: (1) A slight postoperative increase of the red blood corpuscles, and a genuine, though very transitory, acute hyperleukocytosis. (2) A primary decrease of hemoglobin, which gradually rises again to normal. (3) After four to eight weeks a lymphocytosis of varying duration. (4) A moderate eosinophilia occurring late, after many months.

The correct understanding of the blood changes after splenectomy in man can only be attained when splenectomy is performed for injury to that organ in a previously healthy individual and when the wound heals without any complications supervening, a condition probably impossible to attain. This study, however, enhances our

[5] Trans. Assoc. Amer. Physicians, 1904.

knowledge of the blood and the changes occurring in it after splenectomy, and justifies the report.

The size of the spleen may be seen in the photographs taken shortly before operation, the splenic area being traced on the patient's body (Figs. 1, 2, and 3), and in the photograph of the removed spleen (Fig. 7). Naturally the splenic area, as mapped out by palpation and percussion while the organ was still in the patient and full of blood, would make the spleen appear larger than is seen after removal. Fig. 3 shows the variations in the apparent size of the spleen as thus mapped out, as well as the marked effect of the severe hemorrhage in May, 1904.

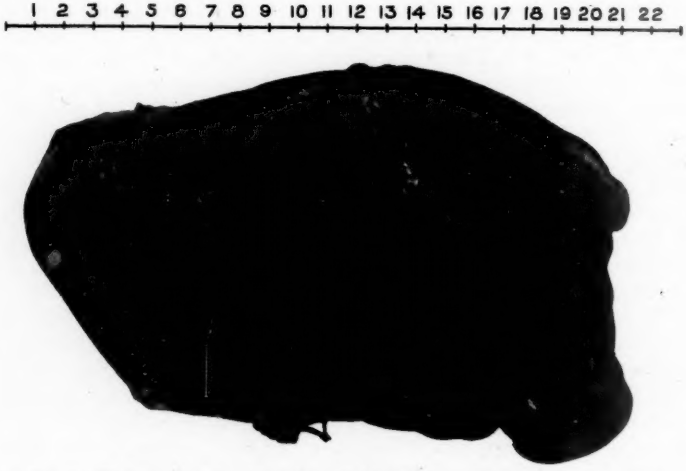

FIG. 7.—Photograph of the spleen immediately after removal. (The measurements are in centimeters.)

The unusual number of ligatures that were required, 23 in all, prove how great was the dilatation of the splenic veins. The application of these ligatures produced no appreciable effect upon the venous circulation, as might have been imagined, but all blood at once ceased to appear in the evacuations, which tends to prove that the spleen is not merely passive in this disease. The enlargement of the liver, so frequently seen, existed for a short time only, about two weeks after the gastro-enterostomy, was accompanied by ascites, and then entirely subsided, and was absent at the operation for splenectomy.

Dr. Warfield T. Longcope, director of the Ayer Clinical Laboratory of the Pennsylvania Hospital, reports as follows concerning the examination of the spleen:

"The spleen is of very great size. It weighs 790 grams and

measures 20 x 13 x 7 cm. It is quite firm in consistency and has a rubbery or leathery feel. It is quite irregular, and there are three fairly deep notches on the upper margin. A great many adhesions cover the capsule, and on the superior surface two depressed white thickened areas are seen. The largest measures 5 cm. and is situated in the posterior portion. The other measures 4 cm. in diameter and is situated in the inferior anterior portion. The color is rather a pale red. On section the cut surface is smooth, slippery, and rather dry. The pulp is firm and of a homogeneous light red color. The Malpighian bodies are very small or invisible. Trabeculæ are very white, prominent, and are much increased in number and size. The vessels at the hilum are clear.

FIG. 8.—Microscopic appearances of the spleen.

"Smears are made from the freshly cut surface of the spleen and stained in Wright's stain. Most of the cells are red blood corpuscles. A few normoblasts are seen. The white cells are principally small lymphocytes. Moderate numbers of large lymphocytes are seen and several much larger cells which are apparently endothelioid cells. Fair numbers of polymorphonuclear leukocytes are met with. Quite a large proportion have eosinophilic granules. No phagocytic cells or red-blood-corpuscle-carrying cells. No cellular inclusions. No pigment.

"Sections are made through various portions of the organ. They

all have about the same appearance (Fig. 8). The capsule is very much thickened and is composed chiefly of hyaline connective tissue. To it are attached irregular projections of fat and connective tissue. Throughout the section there is a very extensive increase in connective tissue, both in the trabeculæ and in the pulp. The organ contains comparatively little blood. The walls of the venous spaces are greatly thickened by a growth of rather cellular connective tissue. In Mallory's connective tissue stain the walls are seen to be made up of a reticulated fibrous tissue. The venous spaces are small. Besides red blood cells they contain a few polymorphonuclear leukocytes, many small round cells, and an occasional large endothelioid cell. Very rarely a red-blood-corpuscle-carrying cell is seen. The cells in the walls of the sinuses are principally connective tissue cells. No uninuclear or multinuclear giant cells are seen. Very few eosinophiles are seen in sections.

"The Malpighian bodies are quite scarce. Many of them are very small. The reticulum beneath the cells is thickened and the follicle is overgrown with connective tissue. Others appear unusually large and show compensatory hypertrophy. They are quite regular. The middle of the follicle is composed of a large germinal centre filled with large irregular pale cells of epithelioid type. The margin is quite regular and is bordered by a narrow dense zone of small lymphocytes. Beyond this is a wider, paler zone of cells, chiefly small lymphocytes, fairly well separated and mixed with a few large lymphocytes and epithelioid cells. The boundary zone is regular and definite. The reticulum is not thickened except in a few instances about the outer border. No pigment is seen. There are a few small areas of blood mixed with fibrin. The connective tissue about the vessels is much increased, but the intima of the blood-vessels is delicate. Taken as a whole, the spleen shows an extreme grade of thickening of the walls of the venous spaces with a diffuse increase in rather cellular connective tissue. Many of the Malpighian bodies are atrophied, though a few are exceedingly large with active proliferating germinal centres.

"Diagnosis: Chronic perisplenitis and interstitial splenitis."

CLINICAL NOTES ON LARYNGEAL TUBERCULOSIS.[1]

By Beverley Robinson, M.D.,

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It seems to me it may be of interest to record some personal observations and experience about tuberculosis as it appears in the

[1] Read at a meeting of the New York Academy of Medicine, January 16, 1908.

larynx. I shall also emphasize certain facts pertaining to its management and treatment which I regard as very important. For many years I had extensive opportunities of seeing and treating this disease. Latterly my patients are fewer, but I have tried to keep track of recent methods, and while in a few instances I believe real advances have been made as to our knowledge of laryngeal tuberculosis, I am also convinced that a return with newer lights to older practice is really the important asset of many among us.

In a fair proportion of cases of pulmonary tuberculosis we have, as we all know, laryngeal complications. These complications are more frequent among men than women, and are reasonably explained by different occupations in which the larynx is exposed to more irritating influences. One fact which seems to me of great importance is the ignoring of the larynx in far too many cases of suspected or confirmed pulmonary tuberculosis. In the first category a laryngeal examination by means of the laryngoscope may frequently fix a diagnosis which is very obscure prior to it. Nor is this examination always less important simply because there are few or no laryngeal symptoms. The voice may be almost, if not entirely, normal at times, and yet there may be inactivity or slight paresis of one or both vocal cords; or there may be marked localized anemia;[2] or there may be slight congestion of one or both vocal cords in a limited area; or the arytenoids may be slightly infiltrated, and likewise the interarytenoid commissure. Yet these appearances are already suspicious; indeed, with a certain history they are more characteristic even than a little prolongation or harshness of the expiratory murmur at the apex of the lung, or an indefinite dulness, which is often nothing more than the result of the percussion note elicited by a finger from a relaxed or possibly corpulent chest wall.

Again, in the very frequent cases of huskiness or hoarseness of voice, more or less remittent or intermittent, and usually considered and treated as a slight cold, or catarrhal inflammation of the larynx, do not the appearances under the laryngoscope enable us often to differentiate properly what is and what is not a first stage of laryngeal tuberculosis? In the former instance the redness is far more general; in the latter it is localized to a limited portion of the vocal cords, the ventricular bands, or other portion of the larynx.

In the cases in which there is marked hoarseness, some intralaryngeal discomfort or pain, or dysphagia even if only moderate, a laryngeal examination of course should be properly made. In every case, and emphatically in all young adults, in whom a cold or cough has unduly persisted despite rational treatment, or whenever the causation seems in any way obscure, we should invariably

[2] Dr. Herbert Maxon King, physician-in-chief at the Loomis Sanitarium, Liberty, New York, writes: "A pallor of the larynx is very significant and often an early sign" of pulmonary tuberculosis. New York Med. Record, December 14, 1907, p. 977.

insist upon a laryngeal examination. Time and time again I have seen an ulceration of the vocal cord, of the arytenoid cartilage or commissure, of the arytenoid folds, and even of the epiglottis itself, when the laryngeal symptoms were not unduly pronounced. And these cases, again, occur, although perhaps infrequently, when the intrapulmonary condition is not perfectly clear and when no tubercle bacilli have yet been discovered in the sputum.

When we have noted any one of the preceding conditions, besides confirming our diagnosis as to the presence of pulmonary tuberculosis in the very great majority of cases, is it otherwise valuable to the patient and to us? Certainly. In the first place, when the laryngeal condition is only catarrhal, will not proper management and treatment prevent it from becoming tuberculous? It is only necessary, as I believe, in some instances, for the mucous membrane to lose its epithelial covering, or to become in the slightest degree abraded, to have a portal of entry for the infecting germ. When the case is one of manifest laryngeal tuberculosis at its initial stage, may we not by judicious management prevent the local disease from extending and getting, sooner or later, beyond our means of control or arrest? To these questions I answer unreservedly, we can occasionally, I believe.

Of course, I admit, and we all should admit, that the general treatment which is wisest and best for the intrapulmonary tuberculosis is also most judicious, even if there be a laryngeal complication. But, on the other hand, there are certain clear-cut indications of management and treatment which proceed directly from the localization. The importance of this treatment must be admitted when we state how great the added suffering often is of the patient who has advanced ulcerative disease of the larynx with the accompanying infiltration or œdema of certain parts, and with the loss of vocal function which is thus occasioned. But this is as nothing to the dysphagia, often allied with increased dyspnœa from obstruction, which makes every act of swallowing a torture. Even when the pain of swallowing has been lessened by anodynes, or position, distressing paroxysms of cough are not obviated by reason of solid particles or fluids penetrating into the larynx.

In the way of protective and curative treatment, what should be insisted upon? In my judgment two things, essentially: (1) rest for the larynx, and (2) inhalations. Upon the great necessity of rest to the larynx, Sir Felix Simon, of London, and after him I[3] insisted many years ago. For several years past, many indeed, the importance of this matter lay dormant, as it were, or, at all events, was not insisted upon as it should be. Again it is to the fore, and during the past year or two, in more than one book and in several journal articles it is amplified and accentuated. In some

[3] Proc. Amer. Laryngol. Assoc., 1880.

sanitaria for tuberculous patients, when the larynx is at all affected, partial or complete silence is insisted upon. As far as may be, everything is written with slate and pencil or upon a writing pad, and the spoken word is not permitted. Of course, we cannot get complete rest for the larynx in this way because every drawn breath, every paroxysm of cough, every act of deglutition causes laryngeal movement, and alas, at times, discomfort or pain; but we lessen movement as far as possible, and by so doing we afford the patient a better chance of cure.

Are the results such as to justify our hopes and expectations? Frequently they are. Congestion and infiltration have greatly diminished or wholly disappeared. Ulcerations, when limited, have entirely healed. And this has come about not only when the general health and intrapulmonary condition have both notably improved, but also when the latter have remained stationary or deteriorated.

There is nothing new about the great value of the principle of rest in many, very many diseased conditions—both medical and surgical—but, except for a broken bone or diseased joint, nowhere else does it seem more useful, in some instances, than in diseases of the larynx. To Hilton, above other writers, we owe a great debt for wise insistence upon this very important fact of the great utility of rest in the management and treatment of many accidents and diseases—both acute and chronic.

In a few instances it has been noted by myself and others that when tracheotomy had been performed for laryngeal tuberculosis, with marked and distressing stenosis, the condition of the diseased parts were notably and favorably modified apparently or, indeed, obviously, by the rest to the larynx thus afforded.[4]

Formerly, in all instances of laryngeal tuberculosis at the initial stage, I made use of atomized solutions followed or not by some pigment locally. Frequently, and preferably, this pigment was tincture of iron perchloride combined with glycerin and water. At a later period, and when there was pronounced infiltration with œdema of the arytenoids, arytenoid folds, or epiglottis, with notable amount of mucus or mucopus covering the posterior portion of the larynx, or filling and obscuring its interior, the frequent use of an alkaline, carbolic spray by means of Sass' tubes appeared to be the best preparatory cleansing application before the use of iron, zinc, tannin, nitrate of silver, etc. These latter applications at this stage were rarely used except of moderate strength, or well diluted, for the reason that otherwise they sometimes caused distressing spasm. And later there was occasionally local and increased laryngeal uneasiness for a time and no subsequent evident improvement in the local condition. Whenever ulceration appeared, was localized,

[4] Beverley Robinson. Tracheotomy in Ulcerative Phthisical Laryngitis, AMER. JOUR. MED. SCI., April, 1879.

and could be readily seen, attempts were made to reach it directly with somewhat stronger pigments by means of a swab, brush, or curved probe on which nitrate of silver had been fused or chromic acid fixed. Rarely, if ever, have I had occasion to make use of the galvanic cautery to infiltration, thickening, swelling, or ulceration. Whenever there was notable excrescence of tissue, more particularly in the interarytenoid fold, I have either made use of the stronger applications referred to, or, as a preliminary measure, employed the tube or other suitable forceps to reduce the redundancy of tissue. In no instance have I attempted to make use of submucous injections in the larynx or the trachea. They never appealed to me strongly as a remedial means of value in these cases, and I always had and have a reasonable doubt as to their real efficacy in the hands of others.

As to the later surgical methods of Krause and Heryng by means of punching and curetting—these I must admit rarely make an appeal to me, especially the former. To punch out a bit of infiltrated, somewhat hardened, or œdematous tissue, over the intact arytenoid cartilage, I do not regard as indicated or desirable. Even incisions or punctures of these swellings are only profitable when the tissues are soft relatively and permit serous fluid to exude in appreciable quantity, as would be the case, of course, in soft œdema of the larynx and when notable stenosis with stridor was thus occasioned. Then, of course, with a properly shielded or curved lancet or knife, very great temporary relief from a very severe and sometimes imminently dangerous condition may be afforded.

If the ulceration be localized, if it be single, or a few ulcerations at most, these may be occasionally curetted moderately with some advantage, and while I have not attempted it myself, I do not object. Such a localized ulcer is not infrequently found underneath—or rather below—the polypoid excrescence of the interarytenoid fold. After the excrescence has been in part or wholly removed by forceps, the ulcer itself may be curretted before a local application is made. It is usually advisable before curetting is done or, indeed, the stronger pigments are applied, that a local anesthetic of cocaine should be made by a swab or spray. This application need not be very strong; a 4 per cent. solution is often sufficient.

Formerly, when I found a patient suffering with laryngeal pain and distress from ulceration and subsequent infiltration or perichondritis, I applied morphine, iodoform, or both combined, frequently to the parts, and thus lessened for a short time the patient's suffering and rendered deglutition somewhat easier in a few instances.

Again, position, notably that of Wolfenden, in which the patient's head hangs over the bed and fluid is sucked through a rubber tube from a mug or pitcher below, will afford relief to swallowing. Today we obtain more relief of pain probably in all abraded surfaces from the frequent local use of orthoform than by

any other known agent. Fortunately, too, orthoform is innocuous, and on this account may be used frequently and by the patient himself whenever required. Leduke's bent hard rubber tube, which may be inserted well back in the throat and through which the orthoform, placed in the orifice of the other extremity, may be aspirated strongly, offers a ready means to the patient to accomplish his purpose. From the experience and reports of many competent observers during latter years no application to ulcers of the larynx has received stronger endorsement than that of lactic acid. Applied in 10 to 80 per cent. solution, or even pure, it modifies the ulceration very favorably. Indeed, it not rarely seems to help the complete healing of the ulcer when single and localized. A local anesthetic is often required before and after its application, and especially is this true whenever curetting has been practised prior to the application of the lactic acid. If the lactic acid is applied locally in strong solution or pure, it should be done with care, so as to avoid undue pain and distress. If used on a swab or brush, any excess of acid should be gotten rid of before it is applied, because if a drop should fall into the larynx, notable spasm of the larynx, sometimes very threatening, will immediately follow.

While I am willing to admit the utility of lactic acid, it is now pretty well shown by the report of H. G. Felkin[5] that its curative effects are markedly increased by complete rest to the larynx, as is afforded by insistence upon prolonged, absolute silence. Felkin's report embraces several cases which belong to him, and some also to Sir Felix Simon mutually. In those instances of numerous small ulcers outside the larynx known as upper tuberculous laryngitis, and in which the prognosis is specially bad, I disapprove of the use entirely of curetting, applications of lactic acid, etc. They cause considerable distress, are of no possible use, and are not justified at all when we consider the advanced, or very threatening condition of the patient from the point of view of the local pulmonary changes, or the general tuberculous infection, which almost invariably accompanies them.

In a few rare cases in which the epiglottis is the seat of deep ulceration, accompanied by very painful dysphagia, it has been found advisable to excise it either by means of a suitable knife or by the galvano-cautery snare. Notable relief from pain has followed in more than one instance, but the result at best has only been temporary, for in a brief period of time the patient has died because of the rapid inroads of disease already far advanced and very infectious in type. Seldom, either from this operation, or curetting, or punching, has any considerable or annoying hemorrhage occurred. One exception should be made in the case of operation

[5] Brit. Med. Jour., 1907, i, 1421.

on the swollen ventricular bands. Here, indeed, notable and worrying hemorrhage has occurred after deep curetting.

I now come, finally, to what I regard as by far the most important local measure to be employed by every sufferer from laryngeal tuberculosis at any stage of the disease, and that is the frequent, persistent, long-continued use of the perforated zinc inhaler (see figure) with inhalations of creosote and alcohol, or, when there is much irritative cough, of beechwood creasote, alcohol, and spirit of chloroform in equal parts. This is no new fact to me, but has become more and more a firm conviction. I have already several times directed attention to it, and I now reiterate it because of its great value. In 1885, at the second meeting of the Climatological Association, I read a paper on antiseptic inhalations, in which I first directed attention to the great value of these inhalations in many forms of laryngeal,

Perforated zinc inhaler.

bronchial, and even pulmonary disease. Later, in my little work on *Inhalers and Inhalants*, I again affirmed the value of these inhalations. And in more than one article in medical journals, or in remarks before societies, since that time, I have recurred to their importance. These inhalations modify sputum favorably, diminish its quantity, lessen cough, thus promoting rest, sleep, and nutrition, and general improvement physically, and in some instances appear to be the means through which the patient has gotten rid of tubercle bacilli permanently. I know of absolutely no other method, no other local application, no surgical measure, which will afford anything like the same amount of relief to symptoms and hasten and promote cure in suitable cases to the same degree as will the perforated zinc inhaler with the inhaling fluid recommended.

It is unnecessary for me at this time to give all my reasons why the skepticism made known and objections urged against the systematic

and continued use of the perforated zinc inhaler fail completely to establish the value of the objector's or doubter's position. The arguments and statements that I have given previously in favor of the use of the zinc inhaler, with the records of many cases observed by me, may be found in the papers and book referred to. Dr. Austin Flint, Sr., further pointed out its great utility in a series of cases of pulmonary phthisis observed by him and published many years ago. This fact I have already referred to.[6]

Only within a brief period, Dr. Lees, late physician to St. Mary's Hospital, London, England, stated, in his farewell address at that institution, that "during the past two or three years he had treated all his cases of this disease (pulmonary tuberculosis) with continuous inhalations by means of a Yeo's respirator,[7] on which was placed a mixture of carbolic acid, creosote, iodine, alcohol, ether, and chloroform. The inhaler[8] is worn day and night, and removed only at meal times. Six or eight drops of the mixture are dropped on the sponge of the inhaler every hour while the patient is awake, and several times during the night. This rapidly relieves cough, and *patients seem to derive great benefit from its use.*" It is a great help and encouragement to me to find unqualified support of what I have believed for so long a time from such a distinguished and accurate observer who has written truly, well, and with wisdom about several other most important matters relating to practical medicine—notably, the great value of blood letting in pneumonia, and the utility of the salicylates and sodium bicarbonate, combined and in large doses, in the treatment of acute articular rheumatism.

"Dr. Lees closed his address with a comparison of the good results which medical treatment can obtain in acute bacterial invasions with the disappointing failure of the most modern methods of therapeutic inoculation in these diseases—a necessary encouragement in these days of pessimism and skepticism as to the value of the drugs and methods which we have used so long."

Last winter I had a patient under my care at the clinic of the Bellevue and University Hospital Medical College, who had advanced pulmonary tuberculosis. His cough was most distressing and his nights, in consequence, sleepless. Nothing gave him any relief except the use of the perforated zinc inhaler. A case of bronchitis, with distressing cough and dyspnœa, reported by me,[9] was only relieved by means of the inhaler. A patient of mine suffering from pulmonary tuberculosis at the stage of infiltration with numerous bacilli in the sputum, one year ago, has been more helped, in my judgment, by the continued use of the zinc inhaler than in any other way, or by any other single measure. I consider this patient now almost

[6] New York Med. Record, 1906.
[7] Yeo's respirator is almost precisely similar to the perforated zinc inhaler I make use of.
[8] New York Med. Jour., December 8, 1888, p. 617.
[9] Ibid., December 8, 1906, p. 900.

well, and at times no tubercle bacilli can be found. It is my conviction that, despite healthful surroundings, proper nourishment, correct habits, and suitable internal medication, his condition would be at present nothing like so good if he had not used the inhaler. Indeed, when he had neglected or given up its use for a time, he was not so well and the bacilli recurred.

I saw a patient last winter with general tubercular infiltration of both lungs, which probably involved a great portion of them. This man had one of the most distressing, continuous, unremitting coughs I have ever known. Almost every rational measure was tried in vain, by myself and others, to give him relief. After the use of the inhaler for many weeks he was like a new man, returned to his work, and his cough had almost, if not entirely, disappeared.

I cannot emphasize too strongly, in this connection, certain facts well known to those of us who have had long and watchful experience, and these are:

1. There is a certain proportion of patients affected with laryngeal tuberculosis, just as those with pulmonary tuberculosis, who do not recover, in whom the disease is not even arrested no matter what treatment may be followed. These cases remain stationary, perhaps, for a little while, but even this is doubtful, and, as a rule, despite all our efforts and doings, the disease marches steadily onward and gradually grows worse, until the final end comes.

2. While we cannot predicate absolutely, from the intralaryngeal evidences of tuberculous disease, as to the extent and stage of the tuberculous disease of the lungs, yet usually, if one localization of tuberculous disease is of bad augury, so is the other in the larger proportion of cases.

Of course, there are exceptions, but they are few, and sooner or later the rule will obtain in the greater number of instances and my statement be verified. This fact is important when we consider fairly what should be done in the individual case of laryngeal tuberculosis. Should we employ methods which are expensive, tiresome, distressing, and useless when we know perfectly well, or could if we only would, what the outcome is to be, or should we content ourselves with promoting our patients' comfort as best we can and effect as much euthanasia as possible in a disease which occasionally is one of the most distressing and heart-sickening that afflicts humanity?

Recently my attention has been directed to valuable researches made by W. Jobson Horne, of London. The results of these researches "show that 97 per cent. of the cases of phthisis experienced symptoms referable to the larynx at one time or another in the course of the disease and the investigation further went to show that the routine examination of the larynx, in persons suffering from symptoms suggestive of early pulmonary disease, would enable a diagnosis of phthisis to be made at a time when the stethoscope

yields no evidence, and that is at a time when the physician can be of greater service to the patient."

In 1905, Mr. Harold Barwell,[10] of London, read a paper on "The Choice of the Method of Treatment in Cases of Tuberculous Laryngitis, with a Plea for the Routine Inspection of the Throats of Consumptive Patients," the conclusion of which is entirely in accord with the feelings of Dr. Geo. L. Richards, of Fall River, Mass., and with my own, in regard to the subject. Barwell, quoted by Richards, writes: "Because it (tuberculous laryngitis) is common in all stages of phthisis, because it may cause no symptoms to attract attention, and because the early stages are much more amenable to treatment, and also because it produces one of the most painful and distressing forms of death, I most strongly urge that all cases of consumption should have their larynges inspected at regular intervals and as a matter of routine."[11]

Of course, in obscure cases, despite very careful laryngeal and physical examination, we should not ignore "one other valuable aid to the early diagnosis" of pulmonary and laryngeal tuberculosis, viz., "the use of tuberculin." It will frequently enable us, as Dr. Edward O. Otis writes, "to establish beyond a doubt the existence of the disease."[12]

We should also admit that occasionally we may be able by means of the Röntgen rays to recognize a pulmonary tuberculous process in an earlier stage than is possible by auscultation, or percussion.[13] Further, the discovery of tubercle bacilli in the feces[14] in obscure cases will alone sometimes make the diagnosis possible. "The application of tuberculin to the eye in diagnosis, which has been recently introduced by Prof. Calmette,[15] of Lille, France, gives promise of great advantages over the fever test."[16]

I should like to commend to everyone a very wise and thoughtful article[17] entitled "Exile and Drugs in the Treatment of Tuberculosis," by Dr. A. Jacobi, of New York. Nestor of our profession, he is also one of our wisest counsellors and most sincere of professional friends in the cause of intelligent, broad-minded, and thoroughly sane medical practice—in my humble judgment. "Modern medical science and art," he writes, "which have succeeded in appreciating the teaching that the best object of man's endeavor is man himself, have tried to utilize nature in all her bounties." Let us remember it always, I pray, and, besides, these other words of great import, "Life is short, and art long, occasion fleeting, experiment fallacious, and judgment difficult."

[10] British Med. Jour., 1905.
[11] Boston Med. and Surg. Jour., August 9, 1906.
[12] Ibid., September 12, 1907.
[13] Ibid., September 26, 1907, p. 420.—Percy Brown.
[14] New York Med. Jour., August 31, 1907.—M. Solis Cohen.
[15] Calmette's earlier observations are further confirmed by those of Dr. Wolff Eisner and other authorities at a meeting of the Berlin Medical Association, Lancet, December 28, 1907.
[16] E. R. Baldwin, "The Ophthalmo-Tuberculin Diagnostic Test: Some Clinical Observations," New York State Journal of Medicine, October, 1907, p. 413.
[17] Amer. Med., December 23, 1905, p. 1063.

I would add a few final words. I am familiar with the report and discussion before the Section on Medicine of the Academy,[18] in regard to the value of Kuhn's lung suction mask for the hyperemic treatment (Bier) of pulmonary tuberculosis. Neither report nor discussion has convinced me that this mask would prove so useful as the much cheaper, simpler, already widely and long time known perforated zinc inhaler, which I vaunt again with additional enthusiasm and conviction. What Dr. Willy Meyer states in his paper, apropos of Kuhn's mask, I reëcho emphatically for the perforated zinc inhaler.

"It will prove to be of especial value in dispensary practice and in the treatment of such phthisical patients as are not endowed with the riches of this world and cannot afford to leave their homes and their families. I, therefore, believe that the perforated zinc inhaler for the treatment of phthisical patients should be promptly introduced into sanatoria as well as in private practice, thus allowing patients afflicted with pulmonary tuberculosis to benefit from the perforated zinc inhaler."[19]

Eli H. Long[20] adds further testimony to the value of antiseptic inhalations in the treatment of laryngeal and pulmonary tuberculosis. "In pulmonary tuberculosis medicinal treatment has been in recent years greatly discounted, in comparison with out-of-door living, good nourishment, and proper adjustment of bodily rest and activity. But local treatment by the use of antiseptic inhalations, is so rational and so useful in incipient cases, as to easily take first place in the medicinal part of the treatment; and the less perfectly the hygienic treatment can be applied in any given case the more important becomes the inhalation treatment, though secondary in value."

At a recent meeting of the Practitioners' Society of New York,[21] I presented a patient who had been under my care for pulmonary tuberculosis. His disease is now arrested, if not cured. The result is due, as I believe, in addition to proper hygienic measures and a sojourn during the past winter at Asheville, N. C., to the prolonged, faithful use of the perforated zinc inhaler.

In conclusion I would again insist upon two things as most essential in the treatment of laryngeal phthisis locally: 1. Rest to the larynx.[22] 2. Dry vaporized antiseptic inhalations. To me the latter are by far the more important, because if they be used even singly they will effect curative results which the former alone can never accomplish.

[18] New York Med. Record, January 9, 1907, pp. 757, 793, 794.

[19] Cited textually from Dr. Willy Meyer's article in Med. Record, except for the substitution of perforated zinc inhaler for Kuhn's mask.

[20] New York State Jour. Med., June, 1908, p. 325.

[21] Med. Record, May 30, 1908, p. 921.

[22] Bardswell and Adams report in Brit. Med. Jour., June 8, 1907, six cases of laryngeal tuberculosis all markedly benefited by vocal rest. In four cases of ulceration these healed entirely. In every case improvement in the larynx was accompanied by improvement of the general condition and the condition of the lungs. All patients benefited greatly with an average treatment of five months and over.

PRIMARY TUBERCULOSIS OF THE MESENTERIC GLANDS.[1]

REPORT OF INFECTIONS WITH BACILLI OF THE HUMAN TYPE.

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Before reporting the cases that form the subject of this paper, it may be profitable and interesting to bring together all other instances in which tubercle bacilli have been found, cultivated, and differentiated in mesenteric glands, in order to see whether we are justified in drawing any general conclusions. I shall not consider the question of the frequency with which primary mesenteric tuberculosis is encountered. This is a subject concerning which inexplicable differences of opinion still exist, as is indicated by a comparison of the English statistics, which show a primary lesion of the intestine and its glands 290 times among 1560 autopsies on children, that is, in 18.6 per cent., whereas, among 369 cases of tuberculosis coming to autopsy in New York and its environs, only 5 were of intestinal origin, a little more than 1.3 per cent.[2] Leaving this question open, let us turn to those cases in which the type of infecting organism has been isolated and studied. On reviewing the literature I have been able to find 71 instances in which this procedure has been followed.

Eighteen cultures were studied by the British Tuberculosis Commission, 27 by the German Commission, and 26 by other investigators. A cursory review of these cases, best seen when they are arranged in tabular form (Table I) brings to light the fact that the majority are instances of infection with the bovine type of bacillus; in fact, 44 of the 71, or 62 per cent., are of this nature. These figures are not conclusive in deciding the question as to the relative importance of bovine and human infection in general, for they consider only one group of cases, and, as I have said elsewhere,[3] only a consideration of a large number of unselected cases of pulmonary, intestinal, glandular, bone, and other infections can finally throw light upon the relative incidence and importance of these two groups of tuberculosis. As yet we have no data based upon such a series of cases. Both commissions have selected too many instances of abdominal tuberculosis to make their results of value from this point of view. The significance of their investigations lies in other directions. However, the fact that 62 per cent. of intestinal or mesenteric gland tuberculosis proved to be of bovine origin is

[1] Read before the New York Pathological Society, February 19, 1908.

[2] Amer. Jour. Med. Sci., 1907.

[3] Archives of Pediatrics, June, 1907.

worthy of note. It means that the tubercle bacillus of cattle is a factor that cannot be disregarded, as Koch maintains, in its pathogenicity to man. Again, when this 62 per cent. is compared to the percentage of bovine infection which has been demonstrated in other organs of the body, it emphasizes the fact that the mesenteric glands form the chief portal of entry for the bovine bacillus, with the tonsils alone to share this distinction.

TABLE I.—A SUMMARY OF REPORTED CASES OF PRIMARY MESENTERIC GLAND TUBERCULOSIS, WITH THE TYPE OF BACILLUS.

Source.	Human.		Bovine.	
	Children.	Adults.	Children.	Adults.
British Tuberculosis Commission	8	..	10	
German Tuberculosis Commission *	7	5	15	
Smith, Trans. Assoc. Amer. Phys.	1	..	1	
Smith, AMER. JOUR. MED. SCI., 1904	1	2		
Smith and Brown, Jour. Med. Research, September, 1907	..	1	1	
Ravenel, Univ. Penna. Med. Bull., 1902	..	..	1	
de Schweinitz, Dorset and Schroeder, Bureau of Animal Indust. Bull., 52, Pt. 2, 1905	..	..	2	
Fibiger and Jensen,† Berl. klin. Woch., 1902, 1904, 1907	1	1	5	
Damann and Müssemeier, Untersuch. der Tb. der Menschen und Tiere, 1905	..	..	..	1
Hoelzinger, Inaug. Diss., Giessen, 1907	..	..	..	1
L. Rabinowitz, Arbeit. a. d. Patholog. Inst., Berlin, 1906; Berl. klin. Woch., 1907	..	..	2	1
Westenhoefer, Berl. klin. Woch., 1903	..	..	1	
Eber, Beiträge z. klinik der Tuberkulose, 1905	..	..	2	
Fife and Ravenel, Proc. Phila. Pathol. Soc., 1905	..	..	1	
Total	18	9	41	3

* In one case, not included in the table, both types were isolated from the mesenteric glands. In two cases in the table a bacillus of different type was found elsewhere than in the mesenteric glands.

† Including cases 4, 5, 6, 7, 8, 11, 12 of authors.

The next point which compels notice is that, of these 71 cases, only 12 occurred in adults. The significance of these figures is somewhat dimmed by the fact that the glands of children were especially selected for the investigations. Nevertheless, although this may not be the correct ratio, all autopsy records show the marked preponderance of mesenteric gland tuberculosis in children as compared to adults. The statistics are absolutely sufficient, however, if we consider children and adults separately in two distinct groups and

compare the proportion of human and bovine infections in each. Such a comparison reveals that, of the 59 cases in children, 41 (69.5 per cent.) were bovine infections, some showing an atypical strain of bacillus, whereas, of the 12 adult cases, only 3 (25 per cent.) were of bovine origin. This difference in the type of infection cannot be due solely to increased exposure on the part of young children to food contaminated with bovine bacilli, such as infected milk, for adults in the course of many years must be similarly exposed. We must attribute this difference to a diminished natural resistance on the part of the child, in the nature of an increased permeability of the intestine, or to lack of protective power of the lymph nodes, or we must concede a degree of acquired immunity toward bovine bacilli on the part of the adult.

When we inquire into the course of the disease produced by the two types of bacilli in mesenteric gland tuberculosis, we find no points of differentiation. In either case the disease is generally progressive. However, instances of limited infections occur in each variety, and are encountered generally when the tuberculous lesion is of secondary importance, the cause of death being some other infectious disease. For example, the bovine type has been found in a solitary calcareous node,[4] and again in the ascitic fluid of a patient who recovered and was well three years later.[5]

As regards the character of the lesions, Baumgarten has claimed that the human type of bacillus more commonly caused caseation, whereas the bovine organism incited calcification. Viewed from this standpoint, the sixty-nine cases show no distinctions. Caseation was found in all but four instances, and these were of the human variety. Whether calcification develops probably depends more upon the virulence of the bacillus than upon its type, and also upon the peculiarties of its host. For instance, the second interim report of the British Commission shows that calcification was almost universally found in the mesenteric glands of swine, calves, and cows fed with human sputum, which may, I believe, be interpreted in this way. Finally, it should be mentioned that the German Commission reports that in seventeen cases of tuberculosis found at autopsy in children dying of acute infectious diseases, animal inoculation proved negative, in spite of the fact that tubercle bacilli were found in these nodes in eight instances, in some cases in exceptionally large numbers. This emphasizes the limitation of animal inoculation and the necessity of microscopic examination in the diagnosis of tuberculosis. It furthermore shows the resistance of children to tuberculous infection and their ability to arrest the disease by killing the invading bacilli.

[4] Berl. klin. Woch., 1907, Nr. 2.

[5] Untersuchungen über die Beziehungen zwischen der Tuberkulose der Menschen und der Tiere, Hanover, 1905.

The three cases that I report are instances of primary mesenteric gland tuberculosis:

CASE I.—A. C., a child, aged three years and nine months, was admitted to the New York Foundling Asylum for malnutrition. No history was obtained. The autopsy, performed January 23, 1907, by Dr. Howland, who kindly sent me the pathological material, disclosed the following unexpected anatomical conditions: Enlargement of the follicles in the lower portions of the small intestine, marked prominence of the Peyer's patches, with three or four deep transverse ulcerations; enlargement and caseation of the mesenteric glands; moderate enlargement of the spleen. The lungs were negative, the mediastinal glands slightly enlarged. The pathological diagnosis was tuberculosis of the intestine and mesenteric glands.

Smears made from the cheesy mesenteric glands showed a few tubercle bacilli. No bacilli were seen in smears from the small, slightly anthracotic bronchial glands. On January 25 two guinea-pigs were inoculated subcutaneously with bits of mesenteric gland, and one with bronchial gland tissue. Twenty-one days later the pigs inoculated with mesenteric gland were chloroformed, as they showed enlargement of the inguinal glands, although they had both gained slightly in weight. Both were found to be tuberculous. Tissue from the inguinal glands, iliac glands, and spleen were used for culture on dog serum and egg media. The pig inoculated with the bronchial gland was chloroformed after thirty-four days and showed no tuberculosis. Cultures were readily obtained from the spleen and inguinal glands; they grew after twenty-three days on the serum and later on the egg media. They appeared as round colonies at the upper part of the tube where the media was in an extremely thin layer. Later they spread out in heavy membranes. The bacilli were in the form of straight rods from 1.5 to 2 μ in length, and were similar in all the tubes. In subsequent cultures they varied considerably in length and contour. Thus, in facility of culture and in morphology they resembled the human type. Intravenous inoculations into rabbits confirmed this opinion. For this purpose 0.5 c.c. of a suspension of bacilli in salt solution, corresponding in density to a twenty-four-hour bouillon culture of typhoid bacilli, was employed. As the table (Table II) shows, the bacilli possessed but slight virulence toward rabbits, causing only local lesions after a period of two and three months. Bovine bacill when thus inoculated invariably produce a generalized tuberculosis.

CASE II.—P. H., an infant, aged twenty-two months, was admitted to the Babies' Hospital, to the service of Dr. Holt, to whom I am indebted for the following information: The family history showed that the father had suffered from a cough for an indefinite period. The child was nursed for four months and then fed on raw milk mixtures. It had a previous history of pertussis and measles, and had been in the hospital twice before, once suffering from an

TABLE II.—DATA OF INOCULATION OF RABBITS WITH PURE CULTURES OF TUBERCLE BACILLI.

	Total age of culture.	Number of transfer.	Age of culture.	Amount inoculated.	Number of rabbit.	Date and method of inoculation.	Result.	Remarks.
Foundling Asylum . . .	44 days	Second	11 days	0.5 c.c.	250	Ear vein, March 31, 1907	Chloroform, June 9 (2 months, 9 days)	A few foci in kidneys and anterior part of lungs.
	44 days	Second	11 days	0.5 c.c.	217	Ear vein, March 31, 1907	Chloroform, July 6 (3 months, 6 days)	Foci in kidneys.
Babies' Hospital	37 days	Second	10 days	0.5 c.c.	213	Ear vein, January 1, 1907	Chloroform, February 6 (2 months, 20 days)	Extensive tuberculosis of lungs.
	37 days	Second	10 days	0.5 c.c.	207	Ear vein, January 1, 1907	Chloroform, February 17 (3 months)	A few foci in lungs and kidneys.
	53 days	Third	12 days	0.5 c.c.	299	Ear vein, January 16, 1907	Chloroform, April 18 (3 months, 2 days)	Tuberculosis of iris. Foci in kidneys and lungs.
Bellevue Hospital. . . .	27 days	First	27 days	0.5 c.c.	208	Ear vein, June 5, 1907	Chloroform, August 5 (2 months)	Two foci in lungs; a few in kidneys.
	27 days	First	27 days	0.5 c.c.	209	Ear vein, June 5, 1907	Chloroform, August 5 (2 months)	Large foci and kidneys.

"acute gastrointestinal toxemia," the second time from "bronchitis and anemia." It was now admitted on account of diarrhœa.

Examination showed the baby prostrated, abdomen lax, and glands not palpable, except those in the inguinal region, which were the size of shot. The temperature on admission was 104.3° F.; the weight, 21 pounds 10 ounces. A diagnosis of tuberculous enteritis was made. Delirium soon supervened and was followed by death.

The autopsy, performed on September 3, 1906, by Dr. Martha Wollstein, whom I have to thank for the pathological material, revealed the following conditions: Tuberculosis of the intestines and mesenteric lymph nodes, fatty liver, splenic tumor. Lungs and bronchial lymph nodes negative. Cultures of the heart's blood showed no growth. Sections of the spleen, liver, lung, ileum, and mesenteric lymph nodes were made. On microscopic examination the liver, lung, and intestine showed no tuberculosis. In the spleen there were many young tubercles. The mesenteric glands showed numerous giant cells with peripherally arranged nuclei, as well as large areas of caseation.

From this autopsy a piece of liver, which appeared normal, bronchial glands of a deep-red color and slightly enlarged, but otherwise negative, and a few large cheesy mesenteric glands were sent to me. Bacilli, many of them long and of beaded appearance, were found on the smears from the mesenteric glands. Five guinea-pigs were at once inoculated subcutaneously, one with liver tissue, and two with bronchial and mesenteric gland tissue respectively. Of the five, the only one to develop tuberculosis was one of those inoculated with mesenteric gland. The autopsy of this pig showed nothing requiring mention excepting marked enlargement of the retrosternal lymph node. This lesion was found in other pigs often when there was but little tuberculous involvement of the lungs or surrounding tissues.

Cultures were made as in the previous case, but owing to a mishap no growth resulted, so that new cultures were made from a pig which had been inoculated on November 8 with some incubated tissue. In twenty-one days discrete colonies appeared upon one egg tube and one dog-serum tube, and soon became confluent and heavy. The individual bacilli were slightly curved and varied in length from 1.5 to 2.5. Virulence tests made with the second and third generation of bacilli, as shown by the table, proved this strain to be of virulence similar to that isolated in Case I. The reaction test on glycerin bouillon confirmed the conclusion that we were dealing with a bacillus of the human type. When inoculated, the bouillon was 2.1 per cent. acid to phenolphthalein, and eighty-two days later it was found to be 2 per cent. acid. According to this culture test, devised by Theobald Smith,[6] bovine bacilli when grown upon acid

[6] Jour. Med. Research, vol. xiii, No. 3.

glycerin bouillon tend to bring the media toward the alkaline reaction, whereas in human cultures the reaction curve, although at first "moving toward the neutral point, soon swings back to a greater acidity."

The father of this child is now strong and healthy, and does not cough. As the infant had been fed on raw milk, we might have been inclined, judging from the history alone, to consider this a case of bovine infection.

CASE III.—This material was obtained from the autopsy of W. M., a boy, aged seventeen years, admitted to the service of Dr. Gilman Thompson, at Bellevue Hospital. His family and previous history gave no indication of tuberculosis. At the time of admission to the hospital, he complained of abdominal pain and diarrhœa of three months standing, accompanied by marked loss of weight and strength.

Examination showed the boy's general condition to be poor. A few rales were heard in the lungs. The abdomen was held rigid and was generally tender; percussion elicited dulness in the flanks, changing with change of position. The diagnosis was chronic pulmonary tuberculosis, tuberculous peritonitis, and tuberculous enteritis. Death followed four days after admission.

The autopsy, performed three hours after death by Dr. Norris, who kindly furnished me the material for examination, disclosed the following pathological conditions: Primary acute tuberculous hyperplastic enteritis, acute suppurative peritonitis, intestinal flora on smears; perforation of ileum; acute serofibrinous pleuritis; acute parenchymatous nephritis and hepatitis; suppurative sphenoiditis and otitis media; persistent thymus; bronchial lymph nodes slightly anthracotic, otherwise negative; mesenteric nodes enormously enlarged, most of them hyperemic, the largest showing on section yellowish areas of necrosis.

The large mesenteric glands which were sent to me on April 15, 1907, were not typically tuberculous on macroscopic examination, resembling somewhat sarcomatous glands. A long search revealed a few acid-fast bacilli. Microscopic examination showed caseation in some sections, in others only a marked swelling and proliferation of the endothelial cells lining the perifollicular spaces. As in the other cases, passage through guinea-pigs was used to obtain pure cultures, bits of glandular tissue being inserted into subcutaneous pockets in the abdominal wall. In this instance both animals died after five days, so that the inoculation of two pigs was repeated with tissue thoroughly washed in salt solution. Both pigs gained in weight, but showed marked enlargement of the inguinal glands. They were chloroformed on May 5, 1907, twenty-three days after inoculation. Cultures were obtained from the inguinal and iliac glands. The growths were profuse and glistening and were successfully transferred to glycerin bouillon. The bacilli resembled

those isolated in Case I, and were mainly straight rods 1.5 to 2.0 μ in length, a few being longer. A suspension inoculated into the ear veins of two rabbits proved this strain to have a low virulence.

SUMMARY. A review of cases of primary mesenteric gland tuberculosis in which the type of bacillus has been differentiated shows that over 60 per cent. have been caused by the bovine type of bacillus. Among children the bovine infections greatly prevailed, whereas in adults infections with the human variety were in the majority. No pathological or clinical differentiation of the two forms of tuberculosis is as yet possible. In children, as well as in adults, bovine or human tuberculosis may become limited and healed and the bacilli may die. In striking contrast to the cases summarized above, it is interesting to note that those reported in this paper, two in children and one in a young adult, were due to the human variety of bacillus, as shown by the morphology, cultural characteristics, and virulence of the isolated strains.

BLOOD CULTURES IN TYPHOID FEVER.[1]

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THE principles established by Castellani and Schottmüller concerning the bacteriology of the blood in typhoid fever and the knowledge that we have in positive blood cultures a means of determining early and with certainty the presence of this disease, have induced many investigators to search for methods of facilitating the work. The recent advances have, therefore, been mainly in the line of demonstrating the ease with which the work may be done; but as the literature indicates, the frequency of positive findings is not greater with the new than with some of the old methods.

Much of the difficulty hitherto experienced in cultivating the bacilli has been attributed to the bactericidal power of the blood. To overcome this hindrance Castellani[2] used large quantities of bouillon, and obtained positive results in 78 per cent. of the cases. Schottmüller,[3] however, used agar, the blood being present in the proportion of 1 to 3 of the medium. He was successful in finding the bacillus in 81 per cent. of the cases.[4] Numerous other methods

[1] Preliminary studies were presented before the New York Pathological Society, in October, 1906.

[2] Settimana Medica, 1899. [3] Münch. med. Woch., 1902, Nr. 38.

[4] If we were to adhere to the theory that the blood of a typhoid fever patient exerts marked inhibitory influence upon the development of the typhoid bacillus, Schottmüller's success in the work must be explained on the hypothesis of Eppenstein and Korte, that agar in solidifying destroys or diminishes the bactericidal properties of the blood.

have been employed for cultivating the bacillus. Lemiere[5] was successful with cultures made from defibrinated blood. Eppenstein and Korte[6] grew the bacilli in oxalated blood. Müller and Graef[7] observed the growth of the bacilli in the fibrin net-work of clotted blood. Klodnitzky[8] succeeded in growing the bacilli from blood laked in ordinary sterile water. In twenty-five cultures made in our laboratory, we found multiplication of the bacilli in oxalated blood twenty-three times (without the addition of any nutrient material).

From these data it will at once be seen that the unfavorable influence of the blood upon the growth of the bacilli has been considerably overrated. We cannot escape from the fact that with a variety of methods the results obtained by nearly all investigators have been uniform. It seems that in working with one or another method many of the real conditions underlying the success or the failure of the work have been overlooked.

Thanks to the coöperation of the attending staff of the Mt. Sinai Hospital, I am able to report 158 blood cultures taken in 131 cases of typhoid fever at different stages of the disease (this series includes 2 cases of paratyphoid, 1 of mixed infection with a streptococcus, and 1 case in which secondary infection by the pneumococcus occurred). The subject matter will be taken up in the following order: (1) A description of the technique of obtaining the blood and of the media used. (2) The results; a comparison of the advantages of the various media; a note on the characteristic appearance of the colony of the typhoid bacillus in glucose agar; and a note on 2 cases of mixed infection. (3) The results in relapses. (4) The relationship of the positive findings to the presence of the Widal reaction. (5) The relation of the bacteremia to the stage, course, and severity of the disease. (6) The significance of negative cultures. (7) A note on the possible significance of the bacteremia in relation to the prognosis. (8) Conclusions.

Technique. The method used in obtaining the blood is that introduced into the laboratory by Dr. Libman:[9] The blood is usually withdrawn from one of the veins in the bend of the elbow. In stout patients and in children, in whom these veins are often invisible or too small, a vein on the back of the hand or the dorsum of the foot has occasionally been used. It is wise to inspect these different parts first, and see where one can best find a vein of sufficient size. After the constriction bandage has been applied above the part selected and the field has been scrubbed with soap and water, it is rubbed with ether, alcohol, and finally with 1 to 500 solution

[5] Münch. med. Woch., 1906, Nr. 32.
[6] Ibid., Nr. 24.
[7] Centralbl. f. Bakt., 1907, vol. xliii, Heft 8.
[8] Ruseki Vratch, vol. vi, Nos. 27, 28, and 29.
[9] Johns Hopkins Hosp. Bull., July, 1906.

of mercuric bichloride. Because a large number of media was used for each blood culture, it was necessary to withdraw a moderately large quantity of blood, 10 c.c. or more. It will be shown later that although the use of so large an amount of blood increases the chances of obtaining a positive result, a smaller amount is usually sufficient. When the work was first taken up bouillon media were mainly used; later the series of eight media used as routine in the laboratory were employed. In the course of most of the recent work the following eleven media were employed:

1. Plain nutrient bouillon (from meat infusion, 0.9 per cent. acid to phenolphthalein[10]) in flasks containing 120 c.c.
2. 2 per cent. glucose bouillon (titre and quantity like medium 1).
3. Plain nutrient agar (0.9 per cent. acid to phenolphthalein).
4. Plain nutrient agar to which $\frac{1}{4}$ to $\frac{1}{3}$ volume of ascitic serum has been added.
5. 2 per cent. glucose agar (titre same as that of the plain agar).
6. 2 per cent. glucose agar with $\frac{1}{4}$ to $\frac{1}{3}$ volume of ascitic serum.
7. Plain agar (neutral in reaction to phenolphthalein).
8. 5 per cent. glycerin agar (0.9 per cent. acid).
9. 10 c.c. of Conradi's bile medium.
10. 5 c.c. of Kayser's bile medium.
11. 10 c.c. of a 0.2 per cent. solution of ammonium oxalate.

The work was more or less developmental in character, and was carried on without any preconceived notions concerning the possible merits of one or another medium. The eight media referred to above, as belonging to our routine series, were numbers 1 to 8 of the above list. The latest studies were made with media 1, 2, 5, 9, 10, and 11. The oxalated solution was used for two reasons: first to test the growth of bacilli in oxalated blood without the addition of any nutrient material, and second, to test the efficiency of this solution as an intermediate measure in blood culture work between the bedside and the laboratory.[11] In the use of the bile media, the directions given by Conradi[12] and Kayser[13] were closely followed. In each series after the blood was withdrawn it was rapidly distributed into the media and incubated at 37.5° C. The cultures were observed from three to seven days, and careful records were made both as to the time of appearance and the features of the growths. The following summaries give the results obtained with the different media:

[10] The titre of 0.9 per cent. acid was chosen because it was found to give a better growth of typhoid bacilli than more acid media. It is part of our routine to make frequent subinoculations from each of the fluid media upon glucose serum agar and plain nutrient agar as well as plain nutrient bouillon and glucose bouillon.

[11] Epstein, AMER. JOUR. MED. SCI., September, 1907.

[12] Münch. med. Woch., 1906, Nr. 34.

[13] Ibid., Nr. 17.

SUMMARY I.

	Medium.	No. of cultures.	Amount of blood. C.c.	Positive results.	Negative results.	Positive results in percentage.	Time in hours.
1.	Plain bouillon	81	2	61	20	75	48
2.	2 per cent. glucose bouillon	86	2	70	16	81.4	38
3.	Plain agar	31	2	12	19	38.7	50
4.	Plain agar and serum	26	1.5	8	18	31	68
5.	2 per cent. glucose agar	83	2	67	16	80	31
6.	2 per cent. glucose agar and serum	20	1.5	8	12	40	58
7.	Neutral plain agar	16	1.5	1	15	6.6	
8.	5 per cent. glycerin agar	32	2	12	20	37.5	68
9.	Conradi (10 c.c.)	28	1.5	16	12	57.5	26
10.	Kayser (5 c.c.)	29	2	17	12	58.6	31
11.	Ammonium oxalate solution (10 c.c.)	25	3.5	23	2	92	29

SUMMARY II. THE TWO BOUILLONS COMPARED.

Both bouillons were used simultaneously in 80 positive cultures.
Both bouillons were positive in 51 cultures, 63.7 per cent.
Both bouillons were negative in 8 cultures, 10 per cent.
Plain bouillon was positive / 2 per cent. glucose bouillon was negative } in 7 cultures, 8.7 per cent.
Plain bouillon was negative / 2 per cent. glucose bouillon was positive } in 14 cultures, 17.4 per cent.
So that in all, plain bouillon was positive in 58 of the 80 cultures, 72.5 per cent., and 2 per cent. glucose bouillon was positive in 65 of the cultures, 81.25 per cent.
Total positive results for both bouillons, 90 per cent.
The average total amount of blood used for the bouillon media was 4 c.c. per culture.

SUMMARY III. AGAR MEDIA COMPARED.

A. Plain agar / 2 per cent. glucose agar } used together in 26 cultures.
Both were positive in 10 cultures, 38.4 per cent.
Both were negative in 3 cultures, 11.5 per cent.
Glucose agar was positive alone in 13 cultures, 50 per cent.
Plain agar was positive alone in 0 cultures, 0 per cent.
B. 5 per cent. glycerin agar / 2 per cent. glucose agar } used together in 31 cultures.
Both were positive in 10 cultures, 30.1 per cent.
Glycerin agar was positive / Glucose agar was negative } in 2 cultures, 6.2 per cent.
Glycerin agar was negative / Glucose agar was positive } in 14 cultures, 45.1 per cent.
Of the total 31 cultures, 2 per cent. glucose agar was positive in 24 cultures, 77.4 per cent.; whereas glycerin agar was positive in 12 cultures, 38.4 per cent.

SUMMARY IV. BILE MEDIA COMPARED.

Both media were used in 27 cultures.
Both media were positive in 11 cultures, 41.8 per cent.
Both media were negative in 6 cultures, 22.2 per cent.
Conradi medium was positive / Kayser medium was negative } in 4 cultures, 14.8 per cent.
Kayser medium was positive / Conradi medium was negative } in 6 cultures, 22.2 per cent.
In the 27 cultures in which both bile media were used, the total positive results obtained were 21 cultures, 77.8 per cent.
The average total amount of blood used for the bile media was 3.5 c.c. per culture.

SUMMARY V. AMMONIUM OXALATE SOLUTION COMPARED WITH THE OTHER MEDIA.

Used in 25 cultures, positive in 23.

A. Ammonium oxalate solution } used together in 19 cultures.
Plain bouillon }

Growth appeared in the oxalate blood in 17 cultures, and in plain bouillon in 13 cultures

B. Ammonium oxalate solution } used together in 20 cultures.
2 per cent. glucose bouillon }

Growth in oxalate blood in 18 cultures.
Growth in glucose bouillon in 17 cultures.

C. Ammonium oxalate solution } used together in 23 cultures.
2 per cent. glucose agar }

Growth in oxalated blood in 21 cultures.
Growth in glucose agar in 20 cultures.

D. Ammonium oxalate solution
Conradi medium } used together in 13 cultures.
Kayser medium

Growth in oxalated blood in 11 cultures.
Growth in Conradi's medium in 8 cultures.
Growth in Kayser's medium in 7 cultures.
Average amount of blood used in this medium was 3.5 c.c.

In studying these results we can readily see which media appear to be best suited for the work. We find that the media can be arranged in two groups, one of which is distinctly favorable to the growth of the bacilli and another which is unfavorable. It is evident, of course, that the word "unfavorable" must be used cautiously, because in any one blood culture the organisms may be few in number and, therefore, may appear on some of the media and not on others. In such instances it is greatly a matter of chance which medium gives positive results. The bacterial invasion of the blood in typhoid fever appears to be more uneven than it is in infections by other bacteria, for even in some cases in which the bacteria are comparatively numerous, we find that the given amount of blood divided equally into like portions of the same medium gives an unequal number of colonies in each portion. This difference is at times very striking. Müller and Graef, in their cultures from clotted blood, had the same experience. I am not able to say what the cause of the uneven distribution is; possibly clumping of the organisms plays some part. I have at times found that fully developed colonies of typhoid bacilli (of the type to be later described) would appear on 2 per cent. glucose agar within the first sixteen hours of incubation, and then thirty-six to forty-eight hours might elapse before any more colonies appeared on the same plate. We must assume from this fact that, as a result of a conglomeration or actual clumping, the respective colonies arise from different numbers of bacilli.

In this connection it may be stated that in the entire series of 158 cultures I have at no time seen so large a number of bacteria in the blood as that observed by Schottmüller and by Schueffner.[14] Whether this difference is due to difference in the type of the cases

[14] Münch. med. Woch., 1907, Nr. 35.

studied or not, I cannot determine; possibly differences in technique may account for the discrepancy.

From the study of the variations which occur in the number and growth on the different media and different portions of the same medium, I am inclined to the belief that up to a certain degree the media exert but little influence on the result of the culture. The bacilli will grow on any medium provided such a medium is not actually antagonistic. It appears that bacilli fail to grow well in neutral media and in media the titre of which is above 0.9 per cent. acid. The experiments of Müller and Graef with clotted blood as well as those of Eppenstein and Korte with oxalated blood, and those of Meyerstein[15] with bile salts led to the belief that the fluidity of the blood was essential to the development of the bacilli. The later work of Müller and Graef showed that the fluid state of the blood for growth is not necessary, as they had observed the growth in the fibrin net-work of clotted blood.

It is likely that a number of bacilli which reach a culture medium are impaired in their vitality in consequence of the detrimental influence to which they are exposed in the body; so that the blood withdrawn for the culture may contain bacilli, few of which, if any, are viable. But the claim so frequently made that the failure of the bacteria to grow is wholly due to the continuation of the bactericidal action of the blood (in vitro) is not supported by experience. The work of Eppenstein and Korte bears evidence to the contrary. They conclude from their experiments that the bacillus develops an immunity against the bactericidal action of the blood of the host. This view gains support from the fact that the bacteria multiply in defibrinated, oxalated, laked, and clotted blood without the addition of any nutrient medium.

What has been said of the cultures on ordinary media applies also to the bile media of Conradi and Kayser. The results with these methods show no advantages over the ordinary methods. My own results indicate a distinct disadvantage. I found no evidence that bile uniformly augments the growth of the bacilli. The experiments which Meyerstein recently performed proved that the bile salts do not possess any "anreicherung" influence upon the growth of the typhoid bacilli. His observations, as well as those of Nicolle and Adil-Bey,[16] and those of Lævy,[17] show, moreover, that these salts exert a detrimental influence upon the growth of other organisms. In conditions, therefore, which simulate typhoid fever and in which organisms other than the typhoid bacillus may be present in the blood, our knowledge of the inhibitory influence of bile on certain bacteria (for instance the pneumococcus) makes it evident that a negative result might be obtained, whereas the use of the ordinary media may result in a positive finding. And, as we have seen, the

[15] Centralbl. f. Bakt., 1907, vol. xliv, Heft 5.
[16] Annales de l'Inst. Pasteur, 1907, No. 1. [17] Virch. Arch., February, 1907, Heft 2.

ordinary media will also not interfere with the development of the typhoid bacillus.

I wish to draw particular attention to the use of 2 per cent. glucose agar.[18] This medium not only permits good growth of the typhoid bacillus and other organisms,[19] but the colonies of the typhoid bacillus develop in it in a characteristic way. The features of the colonies on the medium are as follows: They usually appear in the first twenty-four to thirty-six hours of incubation and are pinpoint in size, with a disproportionately wide area of green coloration around them. This areola is well defined at the circumference, and may be limited by a ring of darkened blood. The colonies show little tendency to increase in size for the first two or three days, whereas the surrounding green areola widens very rapidly. This description applies only to colonies of typhoid bacilli in the depths of the medium. The surface colonies also develop a green color, but they are much larger than the deep colonies and present nothing that may be considered characteristic.

The development of a green coloration about the colonies in the glucose blood medium is a feature that is not restricted to the typhoid bacillus itself; other bacteria may give rise to the same phenomenon. Ruediger[20] studied the question of the production of this pigmentation, and found that the pneumococcus, the streptococcus, Staphylococcus aureus, and the typhoid bacillus produce it; whereas, Bacterium coli does not, producing instead a rapid and diffuse hemolysis. From our experience, however, the only colonies that need to be considered from a differential standpoint are those of Staphylococcus aureus, Bacterium coli, and the para-colon group. Staphylococcus aureus grows usually in much larger and more disk-like colonies; and in addition to the green color which it produces, there develops within twenty-four to thirty-six hours a clear area (complete hemolysis) immediately around the colonies between the colony and the area of green coloration. The hemolytic ring may be very narrow and in the early stages of incubation may be entirely absent.

In one case of general infection by the colon bacillus, which we had the opportunity of studying, the colonies in the glucose medium developed to a much larger size within the given period than do colonies of the typhoid bacillus. They showed, moreover, a greater tendency to break through and spread out upon the surface of the medium, and produce gas. Gas bubbles were also produced by the paracolon bacillus, but the colonies otherwise resembled very closely those of the typhoid bacillus.

When, therefore, we find that stained smears from the colonies of

[18] Libman, loc. cit.

[19] Although this medium is better than the bile media for routine work, in connection with bacteria other than the typhoid bacillus, it is sometimes not as good as agar unless serum be added.

[20] Jour. Infect. Dis., September, 1907.

the type described as characteristic for the typhoid bacillus show the presence of a Gram-negative bacillus, we can safely place the organism in the typhoid-colon group.[21] Moreover, when colonies are present on this medium which do not correspond to the type described the presence of the typhoid bacillus may be excluded. The character of the colony which the typhoid bacillus produces on 2 per cent. glucose blood agar affords us then a great help in identifying the organism early. Most of our positive results on the glucose agar were obtained within twenty-four hours after taking the culture. In some instances the typical typhoid colony developed within sixteen hours. Delay in development of the colonies may at times be accounted for by errors in the titre of the medium.

Of the 154 cultures taken promiscuously, some for diagnosis and others for research, 110 gave growths of the typhoid bacillus and 2 of paracolon (so-called paratyphoid) bacilli. In 1 case of typhoid fever, complicated by pneumonia and otitis media, a streptococcus was obtained from the blood. The typhoid bacillus was no longer present (the Widal reaction was positive). In another case studied through the kindness of Dr. Eli Moschkowitz, both the typhoid bacillus and a streptococcus were found in the same culture. The results obtained with 2 per cent. glucose bouillon, 2 per cent. glucose agar, and ammonium oxalate solution were the most encouraging; so that our experience leads us to suggest the use of these three media for diagnostic work. As for the quantity of blood, it may be said that 2 c.c. is sufficient to give positive results in 80 to 85 per cent. of positive cases; but when a larger amount of blood can be withdrawn without inconvenience, it is desirable to obtain it, especially in the later weeks of the disease when the organisms are apt to be very few in number. It is necessary to draw attention to the fact that while the total percentage of our positive results is about the same as that given by other authors, more of our cases were studied during the third and fourth week, and as the results are generally considered to be better in the first and second week, the methods which we have decided to adopt for routine work seem to promise better results than the methods generally used.

SUMMARY VI.

Week of disease.	No. of cultures.	Cultures positive.	Widal positive.
1	8	7 (88.5 per cent.)	2 (28.5 per cent.)
2	44	39 (88.6 ")	28 (63.5 ")
3	42	25 (60 ")	36 (86 ")
4	15	8 (53.3 ")	12 (80 ")
5	7	5 (71.5 ")	5 (71.5 ")
6	3	1 (33.3 ")	3 (100 ")
7	3	1 (33.3 ")	2 (66.6 ")
Total	122	86 (70.5 ")	88 (72.1 ")

[21] All the bacilli isolated in our cases were, of course, further identified by the study of their cultural features and by the presence of agglutination with immune typhoid serum.

SUMMARY VII. RELAPSES

Intercurrent relapses, 5—all positive.

Day of relapse.	No. of cases.	Result of culture positive.
2	5	3
3	5	4
4	2	1
5	4	4
6	2	2
7	2	1
11	1	1
12	1	0
14	1	0

The last two summaries permit us to draw certain deductions concerning the efficiency of the blood culture as a diagnostic means in that stage of the disease when other means are unavailing. They also draw our attention to the investigation of the relationship of the bacteremia to the course of the disease. As shown in Summary VI, and as already mentioned above, the results obtained agree in general with those of other investigators. The relationship of the positive blood culture and the positive Widal reaction has been studied by a number of authors. The statistics of Coleman and Buxton[22] show that many of the positive cultures antedate the presence of the Widal reaction. Ghaetghens'[23] studies showed that of 917 Widal tests made, in the first week of the disease, 25 per cent. were negative, in the second, 10 per cent., and in the third, 4.7 per cent. He also found that in 140 cases in which the Widal reactions remained negative, 34 were diagnosed by positive blood cultures, an experience previously shared by a number of other observers. Our own results confirm the previous observations.

The lack of relationship between the result of the culture and the type and severity of the disease has also been noted by nearly all the writers who have reported on large series of cases. Although some fever is usually present at the time when the blood culture is positive, there is no direct dependence of the result upon the height of the temperature. A positive result may be obtained with the temperature at 100° F. as likely as at 105° or 106°, provided such a temperature occurs in the course of the active stage of the disease. A number of our cases yielded positive results shortly before defervescence; that is, within one, two, or three days, but in no cases was a positive result obtained after defervescence was established. Conradi's results in afebrile cases of the disease are certainly exceptional. Coleman and Buxton state that in cases with a long duration, the bacillus is in the blood as long as the temperature persists. My own results support this view in part only. We must distinguish in prolonged cases between those in which the prolongation is due to the fever alone, and those in which prolongation of the tempera-

[22] Amer. Jour. Med. Sci., June, 1907.
[23] Arbeiten aus dem k. Gesundheitsamte, 1907, Heft 1.

ture is due to some complication (such as phlebitis or bronchopneumonia, etc.). In the former group of prolonged cases positive results can be expected. The cases with intercurrent relapses may be regarded in the same group as the last mentioned. The five cultures of our series which were taken in such cases were all positive (Summary VII).

We have had the opportunity of studying 23 relapses; 16 of these gave positive results, approximately 70 per cent., a figure which is nearly the same as that given by a study of the primary attacks. Our experience with negative cultures during the afebrile period warrants the conclusion that in the relapse we are dealing not with the continuation of the original bacteremia, but a new bacteremia. In the intercurrent relapse it is possible that the bacteremia is continuous with the original bacteremia. In 4 of the 16 cases of relapse with positive results, negative results were obtained in the primary attack. An analysis of the results obtained on different days of relapse shows (although the series is too small as yet to be conclusive) that the results are better when the fever nears the fastigium than they are in the earlier days. In 1 case we had the opportunity of making cultures on the third, seventh, and eleventh days of a relapse. The first two cultures were negative, and the third positive. This observation also confirms the view expressed by Schottmüller, that in the true relapse there is a new invasion of the blood.

From a consideration of the results obtained by most investigators it appears to be certain that the bacteremia is concerned in the production of at least some of the clinical aspects of the disease. As Coleman and Buxton state, the number of positive cultures is such that one must conclude that the typhoid bacillus is present in the blood in every case of typhoid fever at some time or other. My own studies with the different media indicate that negative results in the early stages of the disease are accidental. These observations are important not only from the standpoint of etiological and pathological studies, but also from the standpoint of diagnosis, for they show that a continued fever (and this conclusion was drawn by Schottmüller and later by Libman[24]) which lasts for several days after the cultures have shown the blood to be free from typhoid bacilli is in all probability not that of typhoid fever.

To sum up, all the results hitherto obtained show that in typhoid fever there is a bacteremia which becomes progressively less marked as the disease goes on. Whether the cases which extend beyond the third, fourth, and fifth week and in which positive results are obtained are due to repeated invasions of the blood current or not, is a question which cannot at present be decided. From the present state of our knowledge it is difficult to formulate a definite view of the

[24] Trans New York Academy Medicine, March 7, 1907.

significance of the bacteremia in typhoid fever. The case recently published by Conradi[25] in which bacilli were present in the blood before the onset of the fever, and the case described by Widal, in which a positive blood culture was obtained on the second day of disease, would appear to lend strength to the view of Schottmüller concerning the close relation of the bacillemia to the fever. Certain facts presented by our own studies make us hesitant concerning the occurrence of bacillemia from the very inception of the disease, for in one case the culture taken on the fifth day was negative, and another culture taken a few days later was positive. In the second case, two cultures taken during a relapse were negative, and the third positive. We are in need of some studies of cases in which the blood cultures were made on the first or second day of the disease (or of the relapse).

Our studies do not warrant us in drawing any conclusions concerning the relation of the number of bacilli present to the prognosis of a given case. Schottmüller and Schueffner are of the belief that there is a relationship. Further studies in this direction are also desirable. It is not at all unlikely that the study of the biological differences of the organisms from the blood of different patients will throw some light on prognosis and therapy.

Our studies permit the following conclusions:

1. The bactericidal influence of the blood in typhoid fever in relation to the obtaining of positive results in the blood cultures has been overestimated. Great dilutions of the blood are not essential; a number of media will give good results.

2. The best results in our experience were obtained with the use of 2 per cent. glucose bouillon, 2 per cent. glucose agar, and ammonium oxalate solution.

3. On 2 per cent. glucose agar the typhoid bacillus grows in such a characteristic way that the presence of a certain type of colony on it is quite diagnostic, and the absence of such a colony points very strongly against the presence of the typhoid bacillus.

4. The bile media were not found to be as reliable as the media mentioned above.

5. The results presented are in agreement with those obtained by others. The total positive results obtained by us are in agreement with the results obtained by others, notwithstanding the fact that more of our cases were studied later in the course of the disease.

6. Although the maximum results are obtained in the first and second week, there is not sufficient proof as yet that the bacilli are present in the blood from the very inception of the fever.

7. Protracted cases yield positive results if the continuation of the fever is not due to complications (or starvation).

8. A continued fever lasting several days after the blood has been

[25] Münch. med. Woch., 1907, Nr. 41.

shown to be free from typhoid bacilli will nearly always prove not to be a case of typhoid fever.

9. The results in relapses are the same as those in the primary attacks. The bacillemia in the relapses is due to a new invasion.

10. We cannot draw any definite conclusion, as yet, concerning the value of the blood cultures in determining the prognosis.

It is with a deep sense of gratitude that I wish to acknowledge my indebtedness to Dr. E. Libman for his advice and constant guidance in this work. To Drs. Hertz, Ryttenberg, and Fried, I wish to express my thanks for their kind assistance.

THE UNCERTAIN RESULTS OF SUTURING NERVES.

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When one reads the reports of the numerous cases of nerve suture and observes the small percentage of successful results, he is forced to conclude either that the repair of nerves is uncertain and erratic, or that the technique of such operations is far from satisfactory. There certainly seems to be a difference in the ability of different nerves to regenerate. Contrast, for example, the perverse persistence of the trifacial in reproducing itself after the removal of segments as much as one inch in length with the obstinate resistance to reunion or regeneration of the median or ulnar nerve after it has been carefully sutured together and apparently placed in the most favorable condition for repair.

Whether regeneration of nerves occurs as an outgrowth from the neuron or central nerve cell, according to Waller, Ranvier, His, Waldeyer, and others, or whether, according to Bethe, Nissl, Dohm, Ballance and Stewart, and Tizzoni and Cattani, the regeneration is the result of proliferation of the cells in the sheath of Schwann, is a matter which has not been decided, but the latter theory seems to be gaining ground.

It is generally thought that immediate suture of a divided nerve is more likely to be successful than secondary suture, but this seems to be a matter of no importance, according to Bowlby.[1] Thus, in 81 cases of primary nerve suture there were 32 successful results, 34 partially successful, and 14 failures, while in 73 cases of secondary nerve suture there were 32 successful results, 26 partially successful, and 15 failures—the primary suture giving 39 per cent. of successes and the secondary 43 per cent. of successes. Powers[2] reviews 22 cases of nerve grafting in which a segment of a nerve from a dog or

[1] An American Text-book of Surgery.

[2] Trans. Amer. Surg. Assoc., 1904.

from some other source was transplanted between the two ends of a severed nerve, with 3 "good" results and 3 "fair" results, 27 per cent. being more or less successful, although Powers says, "One is forced to question the authenticity of some of the results accounted 'satisfactory,'" and concludes by expressing the opinion that nerve transplantation should be discarded. Powers reviews also 11 cases of flap operations, in which a flap was turned down from one or both ends in order to bridge the gap, with 4 complete or partial successes, 2 failures, and 5 discarded as having been reported too early or as lacking in detail; 10 cases of implantation or anastomosis, in which one nerve was implanted into another, with about 50 per cent. of "encouraging" results; 7 cases of bone resection, but does not give results; 5 cases of suture à distance, with encouraging results; and one case of tubulization.

Murphy[3] gives the following: Implantation for poliomyelitis, 11 cases, 1 success, 6 improvements, 1 failure, 3 too early to know the result; for facial paralysis, 33 cases (including 2 of tic convulsif); 21 of faciospinal-accessory and 12 of faciohypoglossal, with 7 successes, 15 improvements, 5 failures, 1 lost sight of, 1 indefinite, 4 too recent to give definite result, but some had improved. Seven had associated movements of the shoulder or tongue. Of the 7 successful cases, 5 were faciospinal-accessory and 2 were faciohypoglossal.

Of operations for rupture of the brachial plexus, A. S. Taylor[4] reports 9 cases with 1 death, and improvement in some cases; but he does not state in how many or to what extent.

Thus, it is seen that the percentage of successes is small even in a large number of operations. It is true that some of the cases were reported too early to know what the final results would be, but this may be offset by the number of eventual failures which are never reported—the inducement to publish failures not being very great.

CASE I.—*Wound by a saw dividing the radius, the median and the radial nerves, and most of the tendons of the wrist; suture of the divided structures.*

C. D., a white boy, aged fifteen years, was admitted to the Emergency Hospital, March 30, 1898, on account of a wound received the day before by a circular saw striking the right forearm just above the wrist. The wound had been temporarily closed and the patient was sent to the hospital for the purpose of having the hand amputated.

On opening the wound and examining the parts, the following conditions were found: Fracture of the radius about 2 inches above the wrist-joint and division of the median and radial nerves, the radial artery, and the tendons of the flexor carpi radialis, palmaris longus, flexor sublimis digitorum, part of the flexor profundus

[3] Surgery, Gynecology, and Obstetrics, April, 1907.
[4] Jour. Amer. Med. Assoc., January 12, 1907.

digitorum, the flexor longus pollicis, the extensor ossis metacarpi pollicis, extensor primi internodii pollicis, extensor secundi internodii pollicis, supinator longus, extensor carpi radialis longior, and extensor carpi radialis brevior. The median nerve was carefully united with fine silk, using through and through sutures, and all the divided structures except the radial nerve and the flexor longus pollicis were united, although it was not certain that in every case the two ends which were united were those which belonged together. The wound suppurated but finally healed, and the patient seemed to be getting pretty good use of his hand at the end of about two months, when he disappeared, and was next seen April 13, 1906, eight years after the injury. A large scar is seen above the wrist, which is exquisitely tender over the middle of the anterior surface. The hand is slightly flexed at the wrist and slightly deviated toward the ulnar side. He has good use and sensation of all the fingers except the index finger and thumb, which are numb to pin pricks on both dorsal and palmar surfaces; cannot flex the index finger or thumb, but can hold objects between the index finger and thumb by a curious trick—he catches the index with the middle finger and brings it down against the thumb; cannot appose thumb to fingers. It is a good useful hand for rough work, although it is evident that the median nerve is still ununited and one end is probably indicated by the tender point in the scar. The patient is not willing to have another operation to free the median nerve from the scar in which it seems to be embedded.

CASE II.—*Gunshot wound of the right arm, severing the median nerve, brachial artery, basilic vein, and the biceps and coracobrachialis muscles; nerve sutured.*

October 19, 1902, N. E. M., a white male, aged thirty-four years, a clerk, was admitted to Georgetown University Hospital, having just been wounded while holding a gun in his hand, the load of birdshot passing through the right arm just below the middle and dividing the median nerve, the brachial artery and veins, the basilic vein, and the biceps and coracobrachialis muscles. The ulnar nerve was stripped bare for a space of two or two and one-half inches, but did not seem to be wounded. There was little hemorrhage, the ends of the brachial artery being filled with coagula.

The ends of the median nerve were united with two silk sutures at right angles to one another, passing entirely through the nerve, the muscles were sewed together with catgut, and the brachial artery ligated with catgut. For a month there was almost complete paralysis of the flexor muscles of the hand, showing that the ulnar nerve had suffered from contusion or concussion.

The bone had been injured by the shot, and a sinus formed which discharged pus several months before healing. It took the patient more than six months to recover the use of the muscles supplied by the ulnar nerve, and he has never recovered the use of those supplied

by the median nerve. Examined July 29, 1904, more than eighteen months after the injury, the following notes were made: Sensation seems normal to pin prick except over back of last phalanx of middle finger; pronation and supination normal; good strong flexion and extension of the three inner fingers, but not quite perfect, the last phalanges not being completely flexed nor completely extended. The index finger is capable of only about half flexion, and the thumb can be flexed only to a very slight degree and cannot be opposed to the other fingers. Still the patient has good use of the hand as salesman in a shoe store, and is unwilling to have another operation for the purpose of improving the condition of the hand.

Evidently in this patient the median nerve has not united, or, if so, the point of union is occupied by scar tissue which interrupts the continuity of the axis cylinders.

The patient was again examined September 5, 1907, and his condition was found to be unchanged.

CASE III.—*Gunshot wound of the left arm, dividing the median nerve and the brachial artery; flap method used in suturing the nerve.*

F. W., a colored male, aged sixteen years, was admitted to the Emergency Hospital June 7, 1904, on account of a gunshot wound received the day before. The charge of small shot from the gun, almost touching the patient's body, passed along the left side, tearing the flesh from the seventh, eighth, and ninth ribs, opening the pleural cavity, then striking the left arm on the inner side about midway between the elbow and shoulder, it passed upward and backward, to emerge posteriorly about one and one-half inches above the wound of entrance.

The patient's condition did not justify the operation for suturing the nerves until July 2, four weeks after the receipt of the wound. From the symptoms it was assumed that the median nerve and brachial artery had been divided. There was inability to close the fingers completely, the thumb and index finger could not be flexed at all, the three other fingers could be flexed partially, the little finger almost perfectly, the ring finger not quite so well, and the middle finger still less. After closing the fingers he had difficulty in extending them. Sensation seemed unimpaired except over the last two phalanges of the middle finger, both dorsal and palmar surfaces. Pronation and supination were possible, and the patient could touch the tip of the middle finger with that of the thumb, but none of the others. While resting quietly the left index finger lay straight, with almost continual successive contractions of the extensor tendon.

Under ether the wound in the arm, partially cicatrized, was enlarged, exposing the lower segment of the median nerve, which was in its normal posi ion by the side of the obliterated brachial artery. After a little search the upper segment was found pointing backward and lying in the upper part of the wound of exit. The two segments could not be approximated—at least an inch of the nerve had been

destroyed. A flap was cut from the upper segment, turned down, and sewed end-to-end to the lower segment with silk—one through and through suture and several in the neurilemma. The other nerves showed no sign of injury.

The wound healed and the patient left the hospital before any change had taken place in the hand.

November 20, 1907. Beyond slight numbness in the thumb and first two fingers, the result is perfect. Flexion and extension, apposition of the thumb to the tips of the fingers, pronation and supination, all are normal. The radial pulse is about as strong in the left wrist as in the right.

There is a suppurating sinus leading to the left pleural cavity. After leaving the hospital, while the wound in the side was still discharging, the physician one day while probing the wound removed from its interior a one-dollar bill, which had been carried from the patient's pocket into the tissues by the charge from the gun.

CASE IV.—*Wound with broken glass dividing the median nerve and several tendons in the wrist; suture of the divid d structures.*

A. C., a white female, aged six years, was admitted to Georgetown University Hospital, December 31, 1904, having just had her right wrist cut with broken glass. Examination showed an oblique, clean-cut wound across the anterior surface of the wrist joint, not reaching quite across the radial side, from which the end of a tendon protruded. The patient was asked to flex the fingers, and at first said she could not do it, but finally did so, slowly flexing the four fingers until their tips touched the palm, but the second and third phalanges were no well flexed. Other tests could not be satisfactorily made, as the child was frightened.

Under chloroform it was found that the median nerve, all four tendons of the flexor sublimis digitorum, and the flexor profundus digitorum had been completely divided, while the flexor carpi radialis had been partially divided. The upper ends of the tendons had retracted from half to one inch and were found by splitting the skin and fascia from the wound upward. All were united, using the same kind of suture for nerve and tendons—silk through and through—and other sutures for the sheath. Profuse suppuration followed, but the wound healed in about four weeks.

Examination March 3, two months and three days after the injury: flexion of fingers about the same, second and third phalanges do not flex completely; most marked in the index finger. The thumb can be approximated to the other fingers with some difficulty, which is greatest with the little finger. There is some numbness of the thumb, index, and middle fingers.

The patient was again examined March 31, 1907, two years and three months after the injury, and he hand was found perfectly normal.

In this patient the flexion of the first phalanges by the interossei

muscles, which are supplied by the ulnar nerve, was beautifully shown, as, although both flexor tendons were completely divided, the patient could still close the fingers, it is true in a loose sort of way, but a careless observer would probably have concluded that the flexor tendons had not been injured.

The ability to approximate the thumb to the fingers must be explained, it seems to me, on the ground that the adductors and part of the short flexor of the thumb, which are supplied by the ulnar nerve, act to some extent for the opponens pollicis, but that such substitution does not always take place is shown by the result in the second case reported.

CASE V.—*Saw wound of the axilla dividing the axillary vessels and the median, ulnar, musculospiral, and internal cutaneous nerves; suture of the nerves; gangrene; amputation below the elbow.*

A. S., a white male, aged eighteen years, was admitted to the Emergency Hospital July 7, 1907, having the day before been thrown against a circular saw. Examination showed a large ragged wound of the right axilla and right side of the chest, extending to, and grooving the neck of, the humerus and dividing the pectoralis major, the axillary vessels, and the median, ulnar, musculospiral, internal cutaneous, and lesser internal cutaneous nerves. The vessels had been closed by the formation of thrombi. The nerves were united after considerable difficulty in finding the ends and determining which ends belonged together, using silk and overlapping the ends.

The lower ends of the median and musculospiral nerves were concealed several inches below the wound, and dissection of the arm below the wound was necessary in order to find them. The wound was partially closed and drainage provided. Next day the hand was cool, and slight gangrene of the edge of the wound was noticed.

July 16, a line of demarcation had formed about the middle of the forearm, so that the forearm was amputated about three inches below the elbow. Recovery followed, but it is too early to expect any restoration of function in the muscles supplied by the sutured nerves.

THE PATHOGENESIS OF TABES DORSALIS.[1]

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THE pathogenesis of tabes dorsalis has excited a great deal of discussion ever since Duchenne[2] first differentiated the locomotor

[1] Read by invitation at a meeting of the Philadelphia Neurological Society, February 24, 1908.

[2] Arch. de méd., 1858.

ataxia he so well describes. None of the more recent reviews of the subject has formulated very definite conclusions, nor acceded categorically to a single theory; none of the framers of these has quite succeeded in accounting for all the clinical facts already ascertained. Having had exceptional opportunities during the last two years to examine the preparations of many observers and to study a very large number of cases of tabes fruste, I wish in this presentation to indicate, as briefly as possible, the reasons for the conclusion reached that in the main the true explanation is that of Nageotte.[3] An attempt is made also to account for the discrepancies between the findings of others and those of Nageotte's remarkable studies upon the radicular nerve.

Avoiding all arbitrary divisions, types, and stages of disease, and sketching as far as possible the processes which occur and the evolution of the symptoms, I postulate in the first place, with the great majority of neurologists, that the tabetic process differs not in kind, but only in locality from the paralytic process, and in the second place I reject the explanation, familiar in the text-book, that tabes is a primary dystrophy either of the posterior column or of the sensory protoneuron as a whole or an atrophy thereof, directly caused by alcohol, prolonged strain, syphilis, or sexual excesses. To make this clear a few anatomical and physiological details must be recalled.

The Lesions on the Posterior Roots.—It will be recollected that in or near the row of foramina between the laminæ of the vertebræ are situated the ganglia upon the posterior roots of the spinal cord, and that the lower ganglia are a considerable distance inside the spinal canal. The nutrition function of the ganglion cells is too well known to require emphasis. But it is perhaps insufficiently borne in mind that the regenerative function of these cells is efficacious only when the fiber concerned possesses a neurilemma, and that within the spinal cord the axons of the root nerves lose this sheath, retaining only the white substance of Schwann.

Between the lower ganglia and the segment of the spinal cord corresponding with each there intervenes several inches, which the radicular nerve traverses in contact with the leptomeninges, which arrangement is shown in Fig. 1. This shows clearly the canal formed by the pachymeningeal reflection as the nerve pierces the theca vertebralis to become peripheral. In this canal it is probable that communication takes place between the cerebrospinal fluid filling it and the lymph in the sheath of the peripheral nerve (Orr and Rows[4]). Figs. 2, 3, 4, 5, and 6, show the lesions

[3] Soc. de Biol., January, 1901; July, November, December, 1902; July, 1904; May, October, 1905; January, 1906. Note sur les formations cavitatious par perinévrite dans les nerfs radiculaires, Rev. neur., 1907. Sur la systematisation dans les affections du système nerveux et en particulier dans le tabes, Congrès Neur. de Paris, 1900. Neuv. Icon. Salpet., 1904, p. 1. Pathogénie du Tabes Dorsalis, Paris, 1903. Rev. neur., 1906; January, 1903.

[4] Rev. Neur. and Psy., 1903, p. 639; 1906, p. 25; 1907, p. 346. Brain, 1904, p. 460.

described by Nageotte in this locality in cases of tabes and tabo-paralysis. Examination shows this lesion in all stages from simple

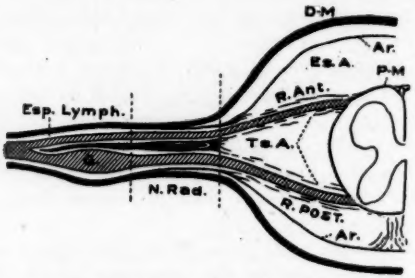

FIG. 1.—Diagram showing the relations of the meninges to the radicular nerve. *N.Rad*, radicular nerve; *PM*, pia mater; *Ar*, arachnoid; *DM*, dura mater; *R.Ant*, anterior roots; *R. Post.*, posterior root; *G*, ganglion; *E.L.*, facultative lymphatic space. (From Nageotte.)

FIG. 2.—*AP*, anterior and posterior roots; *Ar*, arachnoid; *DM*, dura mater; *G*, intervertebral ganglion. (From Nageotte.)

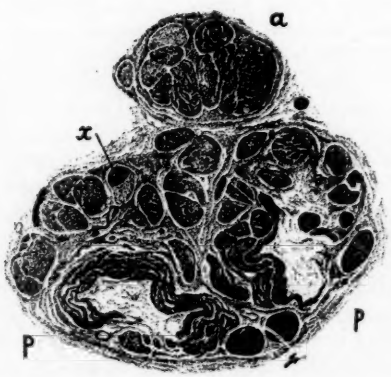

FIG. 3.—Cross-section of the radicular nerve in a general paralytic in which the lesions of the anterior root (a) were more prominent than those of the posterior root (p). The section is at line 3 of Fig. 2 in which the posterior root is involved also. Note the perineuritis with its cavity formation, and the paler bundles of degenerated fibres even where there is no perineuritis. The bundle *x* is half intact. (From Nageotte.)

round-cell infiltration, through granuloma, toward necrosis with cavity formation. They are the fruit of complete serial sections of several radicular nerves in each of eleven cases of this disease.

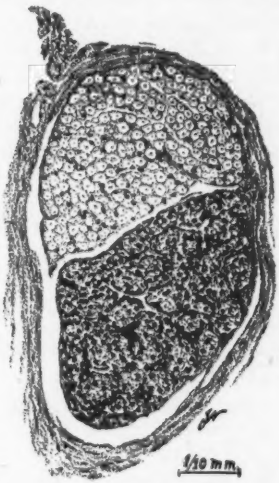

FIG. 4.—The region *x* in Fig. 3 magnified 90 diameters to show the healthy fibers and those from which the myelin has disappeared. (From Nageotte.)

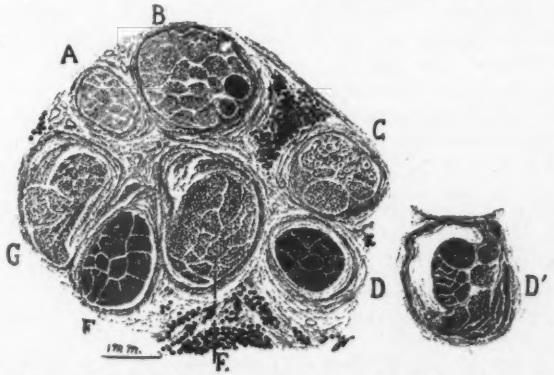

FIG. 5.—Cross-section of the radicular nerve in a tabetic, showing the round-cell infiltration. The bundles *F* and *D* are spared, while all the rest are degenerated. *D'* is a cross-section of *D* lower down. Notice the area of lacunar perineuritis which displaces some fasciculi. Lower still this necrosis was found to occupy the centre of the bundle. (From Nageotte.)

Now, even the chronicity of the infection and the comparatively indolent reaction of the granulomatous process are in this situation sufficient to affect seriously the nerve fibers contiguous to the in-

flammatory area; for in the circumscribed canal of unyielding dura mater, the pressure of toxic effects of the exudate impinges upon the nerve fibers surrounding. These are either destroyed, or at least sufficiently injured to prevent the passage of the impulses from the ganglion cell, which subserves the trophicity of the distal portion of the fiber, which accordingly degenerates. Their lack of neurilemma prevents their regeneration, even after the granuloma has undergone absorbtion; and the postmortem appearance of tabes dorsalis is thus constituted. Regeneration, however, does occur in the posterior root itself just as far as Obersteiner's ring; and it is to this cause that we must attribute the many attempts to refer the tabetic process to a primary dystrophy; for the earlier pathologists had not conceived that what appeared a healthy structure, was the real source of the lesion which they found in the posterior column of the spinal cord.

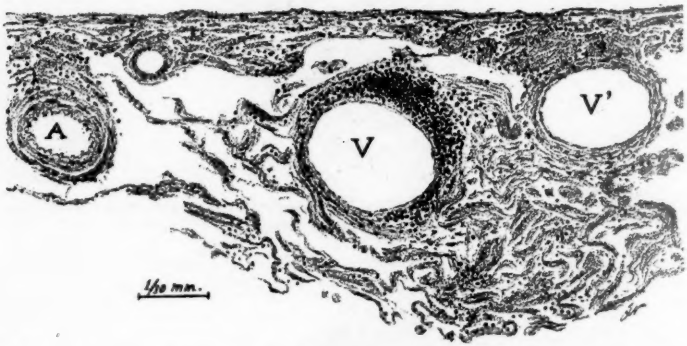

FIG. 6.—An area of old meningites in a tabetic. The process is in resolution except around *V*, where an inflammatory nodule is in full development. Note the sclerotic atrophy of the walls of the artery *A* and veins *V* and *V'*. (From Nageotte.)

Nageotte's opinion that the process is toxic does not accord with the findings of similar posterior column degenerations with evidence of pressure upon the roots, in cases of cerebral tumor (Lejonne[5]) in which the manometric pressure of the spinal fluid is increased; and it would seem that the mechanical factor of the granulomatous infiltration was enough to account for the tabes, although the experiments of Orr and Rows show that causes purely toxic may produce degenerative changes.

THE DISPARATE DISTRIBUTION OF THE LESIONS.—The preponderance of the process upon the fibers of deep sensibility is connoted by the name given to the disease by Duchenne, of Boulogne, locomotor ataxia. Its occurence may be due to as yet unascertained peculiarities in the course of these fibers, which we

[5] L'Encéphale, March, 1907.

know to accompany the motor nerves. A search among carefully described cases of tabes, however, shows that other anomalies of sensation are very much commoner than the classics allow; it is probable, therefore, that it is merely the inconvenience entailed by the impairment of this function which is the cause of the stress laid upon its involvement when the pathology of tabes is considered.

Figs. 3 and 4 show how disparate is the involvement of the fasciculi composing the radicular nerve. Whether this is due to an elective affinity of a toxin for a particular sensory system, or whether it is due to an accidental incidence depending on the local differences of arrangement, cannot be affirmed with certainty. Clinical evidence seems to indicate that some of the fibers subserving the sensation of cold are spared relatively long; but no accurate data yet exist to indicate whether these fibers belong to the protopathic or epicritic systems demarcated by Head.[6]

The fibers subserving the sense of attitudes and those of deep pain are considered to be particularly early affected; and Marinesco[7] has shown that the former is generally associated with the appreciation of vibration, which is much impaired in the course of tabes.

THE DISSOCIATION OF THE SENSIBILITY; THE CAUSES OF THIS.—Head has shown that these are two functions of deep fibers accompanying motor nerves. Spacing sense, thought by him to be in part a function of the same system, has not yet been sufficiently investigated in tabetics; but the implication of the two foregoing shows that the lesion must be one of the peripheral sensory neurons; for these two modalities of sensation become dissociated in the spinal cord, and would require two separate lesions for their implication, sense of position and movement passing homolaterally in the posterior column, while deep pain joins superficial pain to pass heterolaterally in a portion of Gowers' tract (Page May[8]). Touch and deep pressure impulses are, on the other hand, amalgamated into a single path as soon as they reach their relay neuron in the spinal cord. They mount cephalad in a heterolateral tract in the neighborhood of the ventral horn. Thus, if a lesion situated in the cord prevents the passage of impulses of deep pressure, it necessarily prevents the passage of tactile cutaneous impulses also, whether these are epicritic or protopathic, these distinctions being solely peripheral as regards their topographical separation (Head and Thompson[9]).

The disparate character of the sensory troubles is shown in "tabes supérieure" and by such cases of radicular astereognosis as were described by Déjèrine[10] and Noica and Averamescu,[11] of Bucarest,

[6] The Consequence of Injury to the Peripheral Nerve in Man, Brain, 1905, xxviii, 116.
[7] Semaine méd., 1905, xxv, 565. Rev. neur., 1907.
[8] The Afferent Path, Brain, 1906.
[9] The Grouping of Afferent Impulses within the Cord and Brain, 1905.
[10] Rev. neur., 1904.
[11] Ibid., 1906, p. 99.

in which the palmar side and corresponding fingers could not identify the bodies palpated.

As other examples of such irregular incidence, the case cited by Dupré and Camus[12] and Camus and Sezary[13] may be cited. A most demonstrative case was that of Babinski and Nageotte,[14] in which the patellar reflex had persisted until death. Postmortem, it was found that the middle root zones were much less affected than the posterior root zones, while the reflex collaterals and the vertical fasciculus of the posterior horn were relatively conserved. This greater implication of the long fibers is, according to Nageotte, rather the exception. He bases this opinion principally upon the marked involvement of the external bandalette of Pierret, which he believes to be a tract of short fibers going to the column of Clark and not furnishing fibers to the column of Goll at all. These he believes to pass in the posterior external field, and perhaps the lower ones in Flechsig's oval. Raymond's[15] case, too, is striking in this regard, as all deep reflexes were retained. Although hypotonia usually accompanies the lost tendon reflexes, yet even these are sometimes dissociated, as in this case. It would appear, too, that the hypertonic muscles of the tabetic may become even spastic, either by involvement of the pyramidal tract, as in so-called tabes combinée (Noica[16]) or by the development of paralysis agitans, as in the case of Bychowski.[17] Reflexes too, may persist for some time although there is grave disorganization of afferent fibers from muscle, tendon, and joint, as evidenced by great muscular incoördination and lost sense of attitudes.

It is a pity that the two cases reported by Long[18] were not examined as regards the vestibular nerve; for the preservation of the patellar reflexes was there combined with great ataxia; and yet postmortem, very little change was found in the lower spinal cord or roots.

The beautiful description by Gowers[19] of the varying character of the lightning pains well shows the irregularity with which the fibers are attacked in the posterior roots; though his interpretation is inconsistent with the pathology for which this paper contends; for instance. "The superficial pains seem to be on the surface or just beneath the surface. They are usually felt at one spot, often only a few inches in extent, sometimes larger, extending down part of a limb, on the ears, on the face and especially about the mouth." "The pain is usually extremely brief, a stab or flash of pain, gone as soon as felt, but recurring." "These superficial pains have one remarkable effect; they make the skin tender. After they have

[12] Rev. neur., 1902.
[13] Ibid., 1906, p. 1174.
[14] Soc. de Biol de Paris, 1905.
[15] Rev. neur., 1906, p. 1182.
[16] L'Etat des reflexes tendineux dans le tabes compliquée de hémiplégie, Jour. de neurol., 1907.
[17] Neurol. Zentralb., 1904, p. 786.
[18] Congrès de Genéve, 1907.
[19] The Pains of Tabes, Brit. Med. Jour., 1905, i, 1.

occurred a few times, sometimes almost as soon as they begin, the skin in that area becomes so tender that if touched the patient feels as if the place was an open sore. If the finger is drawn gently over it, the pain produced is often hardly bearable. A remarkable fact is that this occurs where sensibility to pain is lost." This description concords with that of the destruction or irritation of protopathic sensation: "the prick of a pin may occasion no pain whatever"(Head). Of the deep pains, the radicular character is as manifest; *e.g.*, "Pain after pain occurs at the same part, separated by a short interval." It is sometimes described as "like the pain of cramp when there is no muscular contraction." Of the girdle sensation, Gowers says that when superficial it is often accompanied by hyperesthesia, but when deep is without corresponding changes in the skin. Gowers also points out its occasional unilateral character.

The paresthesiæ are an endless list, and false interpretations are very probably due to the different degree of involvement of deep and epicritic fibers. His case of tabetic neuralgia without loss of the knee-jerks is a striking confirmation of this point of view; for the pains were entirely superficial; he could not bear the prick of a pin, but the sensation to touch was perfect. What is this but a protopathic paresthesia? There were five similar cases, all thus characteristic of root pain. Now, reference to Head's cases and those described by Lebar[20] will show that hyperesthesia of this nature is not due, as Gowers[21] thinks, to irritation in periphery, but in nerve trunk. The nutritional changes also confirm Nageotte's point of view.

In one case a cutaneous erythema with numerous small white spots accompanied the pain;[22] in one, the localized pain of the scalp was followed after a week by bending and breaking of the hairs about an eighth of an inch from their emergence. These phenomena conform to the trophic ones which Head[23] considers as dependent upon protopathic fibers.

The radicular distribution of the trophic changes is not consistent with their peripheral origin. The resemblance, too, of the arthropathy and osteopathy to those of syringomyelia is striking; but in the latter case the lesion affects the vasor centres in the intermediolateral column, and possibly certain other root fibers also; whereas, in the tabetic process it is the conducting fibers alone which are involved. The effect, however, does not differ. That these dystrophies are dependent upon the interruption of afferent impulses is, however, shown by the disappearance of the perforating ulcers when rest to the limb is enforced for a few weeks. It is only then that the ulcer can be adequately protected from the unfelt traumas which interfere

[20] Thèse de Paris, 1906.
[21] On the Nature of Tabes, Brit. Med. Jour., 1905, p. 57.
[22] The Dystrophies in Tabes, Brit. Med. Jour., 1906, p. 1267.
[23] The Afferent Nervous System from a New Aspect, Brain, 1905.

with its healing. Such an exposed surface would normally be so painful that the patient would be compelled to rest; but the painless mal perforante offers no inducement to this.

One of the hitherto unrecognized paresthesiæ is pruritis. Its characters, as pointed out by Lamy[24] and Millian[25] strikingly exemplify the irregular incidence of the tabetic process; for though generally bilateral, it may be confined to one side, and it usually coincides with a segmental area presenting other symptoms such as hypo-esthesia, or visceral crises. It naturally occurs only during the earlier stages of the disease.

The researches of Sherrington[26] and others have shown that the motor nerves of the anatomist are also accompanied by sensory fibers. These fibers proceed from end organs within the substance of the muscles, known as the muscle spindles. These spindles are sensitive to the deformation they undergo upon contraction of the muscles. It is possible that they are more exposed to noxious meningeal influences than other fibers which preceed straight into the posterior root. This perhaps explains the frequency of their involvement in the meningeal inflammation which leads to tabes dorsalis; though unpublished researches of Ransome, kindly communicated to me by Dr. Donaldson of the Wistar Institute of Anatomy, show that in rats at least these fibers are well mixed with those of cutaneous sensation by the time they reach the spinal ganglion. (See also Ingbert[27]). When the clinician investigates the loss of deep pain by pressing the ulnar nerve behind the elbow, pinching the Achilles tendon or faradizing the sural muscles, he is ascertaining the diminution of a function conveyed by these same nerves. Each of these symptoms is very common (90 per cent., Déjèrine[28]) quite early in the disease.

As a matter of fact, other fibers are not spared; and if the disease is not arrested or cured or ended by death, all forms of sensibility are destroyed. The disease, however, progresses very slowly in most cases, although some rapid cases have been mistaken for acute myelitis, just as fulminating phthisis has for croupous pneumonia. As in tuberculosis, the individual lesions tend toward arrest, while the process tends to progress, the rate varying with the individual and the circumstances.

THE MUSCULAR ATROPHIES.—This tendency to local arrest explains the infrequency of serious myopathies; for Nageotte has shown that the anterior roots often degenerate. The possibility of their regeneration has not been generally accepted. But these and other cases, as well as the regeneration of the posterior roots, definitely shown by Bickles[29] experiments should compel the most

[24] Soc. méd. des hôp. de Paris, 1015.
[25] Jour. Physiol., 1894, xxv.
[26] Semeiologie du système nerveux, Traité de Path. Gën. de Bouchard et Brissaud, 1904.
[27] Jour. comp. neurol., vol. xiii, No. 11.
[28] Ibid., 991.
[29] Ueber das Verhalten des proximalsten (extramedullaren und pialen) Teiles der hinteren Wurzeln bei Degeneration und Regeneration, Neurol. Centralb., 1907, xx.

recalcitrant to accept the evidence of Nageotte's preparations as regards the anterior roots.

Muscular atrophy, however, is much commoner in tabes than earlier writers allowed. Witness the cases of Déjèrine,[30] Souques,[31] Marie,[32] Oddo,[33] Camp,[34] and Raymond.[35] Nageotte's case of Aran-Duchenne palsy in a syphilitic, ataxic in the evenings, in which the patellar reflexes had disappeared, but who showed photomotor reflex iridoplegia and lymphocytosis, and whose symptoms began with ulnar neuralgia, is undoubtedly a tabetic, though the muscular atrophy may of course be of independent causation.

The recollection of the pathological principle upon which this depends would have saved many from their undue skepticism in this regard. It is sufficiently well known that nerves possessing a neurilemma will regenerate when no longer shut off from their trophic centre.

WHY THE ANTERIOR ROOTS REGENERATE EFFECTIVELY.—The trophic centre of the anterior root is the pyramidal cells in the anterior horn. Upon the absorption of the meningeal exudation which has interrupted that influence, they push out new fibers, which Nageotte has figured, and these, finding no interruption, wend their way once more to the muscular fibers which they innervate.

WHY THE POSTERIOR ROOTS DO NOT REGENERATE.—In the posterior root on the other hand, the portion of the fiber distal from its trophic centre, the spinal ganglion, loses its neurilemma on entering the central nervous system. Having suffered degeneration through the meningeal exudation upon the posterior root, that is, between itself and its trophic centre, its want of neurilemma deprives it of the power to regenerate, even when the trophic centre regains access; for the regenerating fibers, as Bickles' experiments show, stop short at the point of reflection of the pia mater at Obersteiner's ring (Fig. 7). Hence from the effects of this lesion no recovery is possible; but permanent disability through muscular atrophy due to anterior root lesions occurs only when the inflammatory exudation has eventuated in cicatrization.

Although I am one of the last to minimize the importance of the psychic factor in the temporary abasiæ of the tabetic, yet I believe that the future will show that these are sometimes, in part at least, due to the evanescent peripheral neuron palsies induced in the manner described. Faure[36] has already shown that ataxia of the trunk muscles is the real cause of some cases of tabetic abasia which were supposed to be pyschic.

[30] Rev. neur., 1905, p. 1218.
[31] Atrophie musculaire dans le tabes, Rev. neur., 1907.
[32] Rev. neur., 1905, p. 146.
[33] Ibid., 1906, p. 587.
[34] Muscular Atrophy in Tabes, Univ. Penna. Med. Bull., 1905.
[35] L'Encéphale, 1907, p. 225.
[36] Congrès de Lille, 1906.

REFUTATION OF OBJECTIVES TO THESE VIEWS.—David Ferrier[37] has summarized the objections to these interpretations of the pathology of tabes dorsalis by stating that the meningitis postulated is not a constant phenemenon, being more frequently absent than present, and when existing, being more of a secondary thickening than an inflammatory process. These objections are completely refuted by the cytological data of lumbar puncture. That lymphocytosis signifies meningeal inflammation, no one disputes. The frequent postmortem findings of thickenings rather than inflammations is explained by the law of fibrosis of individual lesions in the history of granulomas, the process itself continuing in other parts.

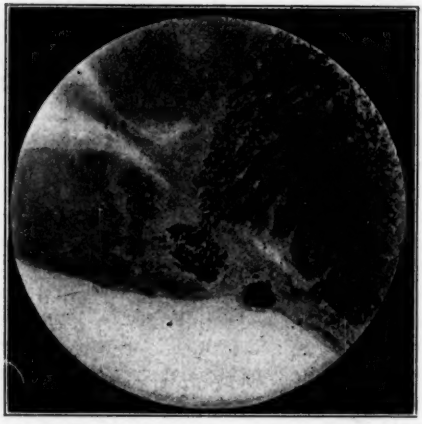

FIG. 7.—Showing the point at which the fibers of the radicular nerve lose their neurilemma. This is outside the cord. The degeneration shown is due to the passage of toxic lymph from a peripheral focus. (Marchi.) (From Orr and Rows.)

Ferrier further objects that in tabes well-marked intramedullary degeneration is often unaccompanied by neuritis or atrophy of the posterior roots. The experiments of Bickles effectively answer this objection, as previously indicated. Ferrier declares unintelligible what he terms the practical escape of the anterior roots, and thinks it contradicts the usual law of the greater involvement of the motor fibers in neuritis of mixed nerves.

This so-called law is an imagination of clinicians, as no one who has studied alcoholic neuritis can doubt; for in this affection of mixed nerves the motor fibers sometimes escape entirely. The fact that the motor neuron is involved in plumbism, often to the exclusion

[37] Brit. Med. Jour., 1906.

of the sensory, is due to its greater susceptibility to that particular toxin. Pharmacological studies show the existence of these selective powers. Ferrier, too, declares that it is extremely rare for meningitis to produce intraspinal degeneration by implication of the spinal roots. This statement is contradicted by the examination of cases of Potts' disease (Alquier,[38]) spinal tumors, etc. Another argument he invokes is the segmental character of tabetic degeneration; but as segmental is a term in this connection convertible with radicular, the logic of this objection is not evident.

Another objection, its symmetrical character, does not accord with the facts, for Babinski[39] and Déjèrine[40] have shown that in the early stages a relative asymmetry is an important character in the tabetic process.

Another objection is the occurrence of degeneration elsewhere, as in cranial nerves, ciliary ganglion, and sympathic system. The cranial nerve affections are, of course, due to a similar basal meningitis, while it is not established that the implication of the ciliary ganglion is an essential part of the tabetic process. The pathology of the sympathetic involvement will be considered farther on in this paper.

The fact that Thomas,[41] in each of six cases, found decided changes in the spinal ganglion cells in no way invalidates the pathogenesis of Nageotte for "reaction à distance" is a well ascertained certainty. Besides, some of the cases of Redlich,[42] Marie and Leri[43] show distinct direct involvement of the spinal ganglia by an inflammatory process which has evidently extended from the meninges. This extension is not at all surprising when one remembers that even the purely mechanical lesions of the root described by Lejonne in cases of cerebral tumor sometimes reach the ganglia.

When the ganglion is directly affected by such an interstitial inflammation, it is not difficult to understand that the function of the cells becomes impaired, or even that their death may ensue. This will be manifested by a dentritic degeneration, which may well begin in the most distant parts, and hence give rise to the symptoms and postmortem appearance of the peripheral neuritis in tabes as described by Déjèrine and others.

I do not, however, wish to exclude the primary peripheral origin of the nerve degeneration in some tabetics, for the infection at the root of tabes does not seem to be confined to the neural canal, as is shown by recent researches, which have shown the commonness of grave interstitial changes in the liver, spleen, and other viscera. Strong objection to the pathogenesis advocated in this paper has

[38] Neuv. Icon. Salpet, 1907; Gaz. des hôp., 1906, p. 687; 1906, p. 2.
[39] Soc. méd. des hôp. de Paris, November, 1901.
[40] Semeiology du système nerveux, Traité de Path. Gén. de Bouchard et Brissaud.
[41] Rev. neur., 1906, p. 573.
[42] Arbeiten aus dem Institut f. Anatomie und Physiologie, 1896, 985.
[43] Traité de Méd., Bouchard-Brissaud, 1904, ix.

recently been made by Beutler[44] on account of the very marked vascular engorgement he found developing in the posterior columns of 14 cases most carefully examined. He believes this too great to be accounted for by the meningitis always present. But it is not unusual to find vascular engorgement of neural tissue undergoing degeneration, and, as previously pointed out, the meningeal lesions tend all the time to regress and leave little trace. As pointed out by Paviot[45] they are often destroyed in the postmortem manipulation.

Spiller, in a verbal communication, states that he invariably finds meningitis present in cases of tabes when carefully examined.

THE NATURE OF THE TABETIC PROCESS.—The transitions between frank tabes, general paralysis, and cerebrospinal syphilis are shown by such cases as the six of Guillan and Tahon[46] and the two of Camp,[47] in which decided meningitis of the cord and vascular syphilitic lesions accompanied the tabetic process. It is unfortunate that in the case of the latter the radicular nerves were not examined. It must not be forgotten that Nageotte and Babinski contend for the primary meningeal location of the disease, and they believe the lymphocytosis to be sufficiently presumptive of this. Marie and Guillain,[48] although they suppose the affection to be purely syphilitic, think that some peculiarity of the lymph circulation in the posterior columns confines the disease to that region. They do not attempt to explain the lesions on the posterior root, for Guillain's[49] experiments only show that the lymph circulation is from the pia toward the central canal.

The experiments of Orr and Rows further show a circulation of lymph from peripheral nerve via spinal ganglion as well as anterior root, into meninges and cord in its whole circumference. These and other considerations led Ford Robertson and Macrae[50] to interpret the tabetic process as a specific one due to a toxin, non-syphilitic, originating in diphtheroid organisms situated in mucous membrane, and whose activity was rendered possible by the lowering of bodily resistance due to antecedent depressing conditions, of which syphilis is probably the commonest.

That meningeal reactions may be produced in this way is shown by Orr and Rows, but as Robertson and Macrae are making further experiments to answer the bacteriological objections made to their contentions, the consideration of this theory must be left to a future occasion.

[44] Thèse de Lyon, 1905.

[45] Soc. méd. des Hôp. de Lyon, 1905.

[46] Soc. Biol., January, 1905.

[47] The Difficulty of Diagnosis between Cerebrospinal Syphilis, Univ. Penna. Med. Bull., xviii, p. 167.

[48] Rev. neur., January, 1903.

[49] La circulation de la lymphe dans la moelle epinière, Rev. neur., December, 1899.

[50] Rev. Neur. and Psy., 1904; May, 1905; February, March, and April, 1906. The Pathology of General Paralysis, Brit. Med. Jour., 1905.

THE SYPHILITIC NATURE OF THE PROCESS.—When the nature of the tabetic process is considered, it is more difficult to steer a clear course. Each in its way, the researches of Marie and Guillain, of Nageo te, of Orr and Rows, and of Ford Robertson and Macrae tend to show that the affection is one of lymphatic distribution, but here agreement ceases. For Nageotte, it is tertiary syphilis of the meninges, and the toxic lymph attacks the nerve root where it makes most intimate and long contact, that is, at the point where it receives its meningeal sheath.

The directly syphilitic nature of the process is supported by such fac s as those of Brissaud and Oberthur,[51] Dorlan,[52] and of Duhot,[53] who reported two cases ensuing respectively two and four years after infection. In each of these the process was rapidly and definitely arrested by intensive mercurial treatment. Another significant fact is reported by Dalous[54] as follows: Out of 21 tabetics presenting pathognomonic, tertiary lesions, 9 denied knowledge of infection or recollection of secondary symptoms.

TABETIC SYMPTOMS IN SECONDARY SYPHILIS.—Symptoms regarded as pathognomonic of tabes are found even in the secondary stage of syphilis. Buttino[55] examined 70 syphilitics from this point of view, mostly during the first year of the disease. He found in a large number of cases a diminution of a transient nature in the light reflex. In 16 cases he found an evanescent leukocytosis. Babinski[56] found it in 7 out of 74 syphilitics of long standing without any nervous symptoms. Dufour[57] examined 611 patients, and found it only in 7, all of whom confessed syphilis. Charpentier[58] failed to find the sign in 1100 healthy individuals, while Sulzer[59] found a fleeting Argyll-Robertson sign in 12 out of 50 syphilitics he examined from this point of view. Dupuy Dutemps[60] and Cestan's research established the fact, and Mantoux[61] collected 64 cases of this kind. Ravaut[62] and Belêtre found lymphocytoses in 58 out of 138 cases of secondary syphilis. This was often associated with exaggeration of the knee reflexes; and both conditions were recovered from under specific treatment. This exaggeration of the reflexes in no way modifies the point of view here sustained; for in polyneuritis, an exaggeration precedes a loss of the deep reflexes.

The association of lymphocytosis and reflex iridoplegia has been insisted upon by Babinski[63] and Nageotte, as has also the association

[51] Congrès de Lille, 1906.
[52] Thèse de Paris, 1906.
[53] Ann. de la Polyclin. Brux., 1903.
[54] Les lesions spécifiques dans le tabes, Rev. de Méd., 1904.
[55] Riv. di. Pat. Nerv. e. Ment., 1906.
[56] Rev. neur., 1898.
[57] Soc. méd. des hôp., 1902.
[58] Thèse de Paris, 1899.
[59] Ann. de dermat. et de syph., 1901, p. 239.
[60] Le signe pupillaire d'Argylle-Robertson. Sa valeur semeiologique, ses relations avec la syphilis, Gaz. des hôp. de Paris, December, 1901, xxviii.
[61] Thèse de Paris, 1904.
[62] Soc. méd. des hôp. de Paris, 1901.
[63] Rev. neur., 1901; Soc. méd. des hôp., 1901.

of the latter with aortitis, now known as the syndrome of Babinski. Irregularity of the pupil was found 12 times in 80 old syphilitics, 5 of them without tabetic symptoms.

TABES NOT A TRUE SCLEROSIS.—The postulate of Weigert that the disappearance of the noble elements is followed by neuroglia proliferation has probably been utilized excessively in the interpretation of such scleroses as are found in locomotor ataxia; for in a pure secondary degeneration of the noble element of the posterior columns due to the excessive pressure of the cerebrospinal fluid upon the posterior roots in cases of cerebral tumor, Lejonne found no neuroglia proliferation in the 15 cases examined. Leri[64] proved by measurement also that the apparent increase of connective tissue elements in the corpus callosum in senile degeneration of the brain was in reality due merely to their closer approximation, from the disappearance of the nerve structures proper. In some cases the corpus callosum was less than half the usual thickness. The diminution of volume in the posterior column in tabes is a pathological fact; and the sclerosis is therefore not hyperplastic but cicatricial. The same considerations apply to the wasting of the posterior roots found by Phillippe[65] in advanced cases of tabes. This absence of sclerosis during an inflammation generally regarded as interstitial has been recently remarkably exemplified by Raymond[66] in a case of comparatively acute multiple sclerosis.

WHY THE SENSORY SYMPTOMS ARE IRREGULAR.—Why then is there irregularity and seeming anomaly in the sensory manifestations of tabetics? Is it not evident that in a process so widespread and irregular in its distribution, it must necessarily be of unequal incidence upon different portions of the nerve roots. That local peculiarities will determine the inclusion of now one bundle, now another, is well shown in such chronic involvement as Pott's disease, in which the research of Fry[67] shows that the same process may pick out and moreover affect unequally, here a band of protopathic fibers, there a band of epicritic; for in his case of cervical Pott's disease, the patches of anesthesia were most irregularly distributed in location, degree, and modality. These may be bundles of epicritic or of protopathic fibers.

One must take into account, too, the errors induced by the exceeding crudeness of the usual clinical investigation of the sensibility, before the researches of Head had indicated methods of precision.

The declaration of changes, more particularly in thermic sensibilities, antedating Head's research, is of small relative value, unless the actual temperatures employed are noted; while the fallacies of the clinical methods in the investigation of touch are by this time

[64] Le cerveau senile; Congrès de Lille, 1906.
[65] Arch. de neur., 1897.
[66] L'Encéphale, 1907, p. 225.
[67] Jour. of Nerv. and Ment. Dis., 1907, p. 185.

familiar to every neurologist. The conclusions of the careful psychometric research of Vaschide,[68] the only one of which I am aware, are vitiated by these considerations.

The investigation of the tactile sense by the haphi-esthesiomêtre of Toulouse-Vaschide[69] is in reality one of the sense of deformation; for its principle is the appreciation of weight. This appears in the research itself, of which one of the conclusions is that the trichesthesia is less involved in the tabetic process. Now Head has shown that the trichesthesia is a tactile function entirely dissociated from the deep sensibility. Vaschide's research, therefore, furnishes valuable data when interpreted in the light we have obtained from Head. In his investigation of temperature, of which the amounts are given, the distinction of epicritic fibers is very manifest with regard to certain roots.

It is possible that the vulnerability of fibers even depends upon the distinction which has been attempted between those of slender structure myelinating late and subserving the life of relation, passing up the cord by the zones of Lissauer (which, however, Nageotte believes to be endogenous); and thick ones early surrounded by myelin whose function is that of internal tactility, including the conscious notion of attitudes subserved by the telencephalon, and the automatic tonus regulating sense presided over by the cerebellum. Bonnien[70] declares that the vestibular nerve is the homologue of the latter posterior fibers, and that a predilection of tabes for this nerve as against the cochlear portion, homologous with the finer fibers, is thus accounted for. As Head has shown, it appears that a single peripheral fiber may convey an impulse which in the cord may select either of these paths.

Were these latter functions always attacked concomitantly, it would be a conclusive proof that the process originated outside the central nervous system; for these two functions follow different paths in the spinal cord, the impulses which go to the cerebrum reaching there homolaterally via the posterior columns, and heterolaterally via the lemniscus, the optic thalamus, and the internal capsule; while the cerebellum receives its information homolaterally via the lateral columns, the restiform body, and the peduncle, and also heterolaterally via Gower's tract and in the main the superior peduncle.

The situation of these cerebellar tracts at the periphery of the cord causes a suspicion that they may be peculiarly susceptible to toxin by extension from the meninges, and may play a greater part in the ataxia of tabetics than one is willing at present to admit;

[68] Bul. ins. gen. psy. de Paris, 1903, iii, No. 5.

[69] L'Examin. des Sujects (dans le Bibliothèque Internationale du Psychologie Expérimentale de Toulouse).

[70] Le tabes labyrinthique, Nouv. Icon. Salpet., 1899; Le sense des attitudes, Paris; Le nerf labyrinthique, Nouv. Icon. Salpet., 1904; Le Vertige, 1904.

although recent researches of Crouzon[71] and of Lejonne[72] show how often they are affected in the mixed scleroses of the aged. But clinical investigation has not yet ascertained whether these functions are in tabes always concomitantly effected. In the periphery, however, a single path appears to convey all impulses subserving sense of attitude whether these ultimately become conscious or not (Head).

VESTIBULAR TABES.—Pierre Bonnier lays great stress upon the vestibular causation of much of the ataxia as well as the oculomotor palsies of tabes. Though it cannot be said that his contention has been seriously examined by others in the light of careful clinical observation, yet it does not seem that clinical study, imperfect as it is, could have failed to distinguish between kinesthetic ataxia and that of vestibular origin. Nor is all disorientation of vestibular source.

This is proved even in the cephalic segment by the vertical stick illusion, in which, with eyes closed and head inclined, a grasped vertical rod appears to incline away from the side to which the head leans; and this phenomenon is quite unaffected by the condition of the semicircular canals or their nerves. It is probably due to kinesthetic interpretations coördinated by experience, and does not differ in the principle of its mechanism from such illusions as the up and down movements of the telegraph wires when passing them in the train, the appearance of the moon passing behind the clouds when in reality the clouds are crossing the moon, and from the deception of altitudes lent by distance, all these being due to the interpretation of unusual experiences by usual standards.

TABETIC STRABISMUS AND NYSTAGMUS.—Bonnier refers the oculomotor palsies to what he terms the bulbar syndrome provoked by irritation of the vestibular nerve, and irradiating via Deiter's nucleus toward one or more of the bulbopontine and mesencephalic nuclei from which Deiter's receives fibers, that is, those of the third, fourth, fifth, sixth, eighth, ninth, and tenth cranial nerves. He attributes to this mechanism the tinnitus, deafness, giddiness sudden falls, even without vertiginous sensations, which sometimes occur in tabetics, as well as Romberg's sign and the oculomotor palsies. He thinks that their basophobia is due to a similar overflow into the pneumogastric, producing a bulbar state corresponding to the emotion of terror, and due to what he terms an unconscious vertigo. He insists that we are no more conscious of the state of absence of vertigo than we are of the absence of thirst; and hence can describe its numerous ways of occurring in only vague terms.

The fact that a patient often falls without any consciousness of vertigo is attributed by Bonnier to the suddenness by which Deiter's

[71] Les scléroses combinées de la moelle, Thèse de Paris, 1904
[72] Arch. gén. de méd., 1905, p. 3009.

neucleus is stimulated by peripheral irritation of the great posterior root, the eighth nerve. He falls before a nerve impulse reaches the cerebrum and constitutes an impression in consciousness. He compares this fall to that of the epileptic without aura.

Etienne[73] has recently reported a similar case.

It remains to be seen whether these cases really differ from those described by Gowers[74] as vagal attacks, which often appear to be of true epileptic nature. They, however, differ in that consciousness is retained in the latter.

THE OPTIC ATROPHY IS DUE TO BASAL MENINGITIS.—The pathological evidences derived from the examination of the optic nerve in tabetics strongly confirm this view of the pathogenesis of the tabetic process.

Originating in the large ganglion cells of the retina, these fibers run a long course in close contact with the meninges until they reach their destination in the superior colliculus and the lateral geniculate body; and although they are not the homologues of posterior root fibers, but of the arcuate fibers in the medulla and the medial lemniscus in the midbrain, yet they are subjected on account of their situation to the same extension of inflammatory processes upon the meninges as are the posterior roots. Although it has been sustained by Popoff and Von Grosz[75] that the lesions were primitively retinal, on account of the disappearance of the ganglion cells of that membrane, yet the persistence of many cells there, even when the optic nerve is completely atrophied, has been shown by Marie and Leri.[76] This would seem to indicate that the process is not primitively ganglionic. It is right to say, however, that Dupuy-Dutemps[77] strongly contends that the real cause of the lost light reflex is a diseased condition of the nerves of the iris.

The amaurosis proceeding from the periphery, and the optic atrophy are the clinical concomitants of this peripheric invasion of the optic nerve. The rarity of the commencement of a tabetic amaurosis by a central scotoma is only to be expected when one recollects that the macular bundle runs in the centre of the optic nerve except at the very beginning of its course, where it is peripheral, upon the mesial side of the nerve (Henschen[78]). It is its involvement at this spot which accounts for the few cases of central scotoma of tabetic causation (Galezowski[79]).

The central scotoma which ensues upon a hemianopic contraction of the visual field has, however, a different significance; for this is due to the invasion of the macular bundle in the heart of

[73] Un cas de syndrome de Bonnier, Rev. neur., 1907, p. 1025.
[74] Vagal Attacks, Lancet, June, 1907.
[75] Congrès Internat. d'Ophthal. Utrich, 1889. [76] Nouv. Icon. Salpet., 1904, p. 368.
[77] Con. d'Ophtal. de Paris, 1906; Annals Occulist, 1905.
[78] Klinische und Anatomische Beiträge zur Path. des Gehirns, Zweite Theil, Upsala, 1892.
[79] Le fond de l'œil dans les affections du système nerveux, Thèse de Paris, 1904.

the nerve in the course of an infiltration proceeding usually from the mesial side (R. Jocqs[80]) (Galezowski).

The very bad prognosis in these cases is due to the smallness of the macular bundle and the fact that a hemiopic contraction is a proof that this bundle has been reached by the inflammatory process. The bundle in the bandalette described by Marie and Leri,[81] which they have always found intact in common with that of Meynert[82] in cases even of complete optic atrophy, has nothing to do with the optic fibers, but runs between the sublenticular region and the basal optic ganglion of Meynert.

Nageotte believes that the zonula of Zinn is the usual site of the lesion.

The Sympathetic Symptoms Also Arise Radicularly.—It may appear strange that our point of view should be confirmed by those tabetic symptoms which are usually referred to the sympathetic nervous system. It will be recollected that Duchenne at one time thought that the lesions found in the cord and roots might be due to a hyperemia induced by a paralysis of the great sympathetic by the tabetic process, and a memorable controversy arose with Vulpian with regard to this. The latter, indeed, found sympathetic lesions only exceptionally, while Charcot,[83] in 1888, stated that even in subjects who had suffered for years from gastric crises, there was no change in the nerves and ganglion of the solar plexus. Raymond,[84] in 1894, thought the integrity of the sympathetic was demonstrated.

This was the state of matters when Jean Ch. Roux[85] was inspired in 1900 by Déjèrine to investigate the question. He examined seven tabetics and ten subjects dead of other nervous and other diseases. In all the latter he found the sympathetic healthy, while in not one tabetic did he fail to find marked and identical modifications in the sympathetic chain and the great splanchnic.

In both of these and in all the cases he found that the small myelinated fibers were diminished in number, in the chain from 4400 to about 500, in the splanchnic from about 2000 to about 1150. It will be recollected that these myelinated fibers are derived from the spinal cord, certainly from the intermediolateral column, where Bruce[86] found as many as 8000 characteristic cells, and possibly from other regions of the gray matter. They are slender fibers possessing a myelin sheath. They leave the cord by the anterior and posterior roots; and they terminate around the sympathetic ganglion cells, from which another fiber takes up the nerve impulse

[80] Atrophie optic tabétique et scotome centrale, Extrait du Receuil d'Ophtalmologie, April, 1906.

[81] Rev. neur., 1905, p. 193.

[82] Psychiatry, Trans. by Sachs, 1887.

[83] Leçons cliniques, 1888.

[84] Leçons cliniques, 1894.

[85] Thèse de Paris, 1900.

[86] The Intermedio-Lateral Tract., Rev. neur. and Psy., 1907.

to terminate in muscle and gland. These latter are the so-called fibers of Remak, and possess no myelin sheath. Neither communicate with the posterior root ganglia.

Now, unless Roux's findings are due to an autonomous lesion, they must be secondary to a process in one or both of two regions, that is, the gray substance of the cord or the spinal roots; and as lesions of the gray substance of the cord have scarcely been observed in tabes, this degeneration of the myelinated sympathetic fibers must be due to the root lesions Nageotte has described. That this is the case Roux showed by observing their degeneration in cats after section of the spinal roots.

That this is not a general part of a peripheral neural degeneration was shown by the conservation of other peripheral nerves such as the intercostal. The sympathetic ganglia, too, were not diseased, nor are any changes presented by the large myelinated fibers which come from the spinal ganglia, as Roux shows these latter were intact in all the cases. Moreover, the diminution of slender myelinated fibers was proportional in the sympathetic to their decrease in the posterior roots in each case.

It is to the destruction of these that Roux attributes the anesthesia of the testicle, bladder, breasts, and trachea, as well as that of the stomach, which he has specially studied. The lack of the sensory innervation is for him the cause of the vesical hypotonia with its consequent ataxia, to which is due the micturitional difficulties of the tabetic. It is to a similar mechanism he attributes the gastric atony, which he believes responsible for much of the ill health and even of some of the gastric crises occurring in this disease.

Genouville[87] showed that when a tabetic bladder is touched by a sound a desire to urinate often follows, while this is not the case in normal persons. To a paresthesia of similar mechanism, Roux attributes the gastric crises and segmental referred pain which his observations show to be frequently provoked by dietetic errors or by drugs. The mechanism does not appear to me to differ in principle from that in a case I now have under observation, in which athetoid movements of the toes take place on stimulation of the skin even by exposure to cold.

The researches of Köster[88] into the trophic changes ensuing upon experimental section of the posterior roots show them to differ in no way from those in tabetics and thus confirm this hypothesis.

I may then conclude:

1. Tabes dorsalis is a secondary degeneration in the posterior columns, due to a chronic meningitis, very probably of syphilitic nature.

[87] Thèse de Paris, 1894.

[88] Zur. Phys. der Spinalganglion und der trophisch Nerv. and zur path. d. tabes; Leipsig, Engelman, 1904.

2. The arrangement of the meninges surrounding the radicular nerve renders it peculiarly susceptible at that spot to mechanical or toxic injury.

3. The unequal incidence of the affection upon different fibers of the posterior root is probably due to unascertained peculiarity of structure or arrangement of fasciculi, rather than to any selective toxic influence.

4. The lesions tend toward resolution and arrest, even though the process may continue during the life of the individual.

5. With this arrest, regeneration tends to occur in the radicular nerve, the amount in the anterior root being relatively considerable while that in the posterior root is less in amount and functionally insignificant, as a rule.

6. The otherwise inexplicable vasomotor and cranial nerve symptoms and postmortem findings in this disease are shown thus to be necessary concomitants of the tabetic process.

7. The question of the pathogenesis of the polyneuritic manifestations found in tabetics is not yet answered.

The practical appreciation of the foregoing considerations to the treatment of tabetics need not be enlarged upon, as it does not come within the scope of the title of this paper; but when correctly applied, I believe another illustration will be afforded of the principle, *Naturam morborum curationes ostendunt.*

A FURTHER CONTRIBUTION TO THE HERPETIC INFLAMMATIONS OF THE GENICULATE GANGLION.

A SYNDROME CHARACTERIZED BY HERPES ZOSTER OTICUS, FACIALIS, OR OCCIPITOCOLLARIS, WITH FACIAL PALSY AND AUDITORY SYMPTOMS.

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This communication is a further elaboration of a syndrome presented at the American Neurological Association, in June, 1906.[1] At that time, three well-recognized clinical types of herpes zoster of the face and neck, with facial palsy and acoustic symptoms, were fused into a single group. The characteristic symptoms

[1] Herpetic Inflammations of the Geniculate Ganglion: A New Syndrome and its Complications, Trans. Amer. Neur. Assoc., 1906; Jour. of Nerv. and Ment. Dis., February, 1907; Archives of Otology, August, 1907.

were attributed to a specific, herpetic inflammation (*posterior poliomyelitis*) of the geniculate ganglion of the facial nerve; and the neural complications, to an extension of the inflammatory process to the adjacent seventh and eighth nerves (Fig. 1). The zoster zone for the geniculate ganglion was thought to be intercalated between the zones of the Gasserian in front and the cervical ganglia behind, and situated on the tympanum, auditory canal, and interior parts of the auricle.

The distinctive features of the clinical picture are as follows: Herpes facialis, herpes oticus, or herpes occipitocollaris, with facial palsy; and in some of the cases irritative and paralytic symptoms referable to the acoustic nerve.

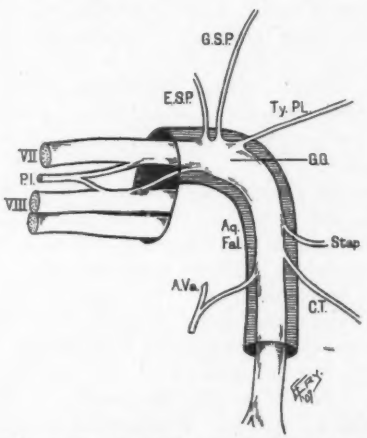

FIG. 1.—The geniculate ganglion, its relations to the facial and auditory nerves: *VII*, facial nerve; *P.I.*, pars intermedia; *VIII*, auditory nerve; *Aq.Fal.*, aqueduct of Fallopius; *G.G.*, geniculate ganglion; *E.S.P.*, external superficial petrosal; *G.S.P.*, great superficial petrosal; *Ty.PL.*, branch to the tympanic plexus. (Cunningham's Anatomy.)

The subject matter of the paper may be conveniently considered under the following headings:

I. The syndrome and its clinical types.
   - A. Herpes oticus.
   - B. Herpes oticus, with facial palsy.
   - C. Herpes oticus, with facial palsy and hypo-acousis.
   - D. Herpes oticus, with facial palsy and Ménière's complex.

II. Sub-groups of the syndrome.
   - Herpes facialis, with facial palsy and auditory symptoms.
   - Herpes occipitocollaris, with facial palsy and acoustic symptoms.
   - Herpes zoster of the cephalic extremity, with auditory nerve complications.

III. Multiple involvement of ganglia in herpes zoster.
IV. The cranial nerve ganglia and their relation to herpes zoster.
V. The zoster zone of the geniculate ganglion.
VI. Sensory symptoms in the trigeminal and cervical zones in herpes zoster oticus.
VII. The ganglia of the glossopharyngeal and vagus nerves and their probable role in zona.
VIII. Concluding remarks.

I. The Syndrome and its Clinical Types. *Group A. Herpes Oticus.* This, the simplest expression of the affection, is dependent upon an herpetic inflammation (*posterior poliomyelitis*) of the geniculate ganglion. It may be preceded by the mild prodromal symptoms of herpes zoster, with preherpetic pains localized in the ear and mastoid region (otalgia). The eruption, which varies considerably in extent, is distributed over the tympanum, external auditory canal, concha, tragus, antitragus, helix, antihelix, and occasionally overlaps into an adjacent marginal zone. In this cone-shaped area is the ganglionic representation and zoster zone of the geniculate ganglion.

In some cases the auricle may be considerably swollen, red, and tender, standing out somewhat from the side of the head. Often the meatus and canal are so reduced in size as to render the introduction of a speculum difficult and painful. Naturally, when the conduction mechanism of the external ear is infiltrated and swollen tinnitus and some temporary deafness may result. This must be carefully distinguished from neural deafness, which will be described in other groups of the affection. The inflammatory swelling subsides rapidly, the eruption desiccating and disappearing in about a fortnight. Postherpetic otalgia, in some cases, may persist for a considerable time.

Group B. Herpes Oticus, with Facial Palsy. In addition to herpes oticus there is an associated peripheral facial palsy on the corresponding side. The paralysis is complete, involving all branches of the nerve, making its appearance with or soon after the eruption becomes manifest. All degrees of severity have been observed, from a very transient form, lasting only a few days, to that which leaves a permanent weakness and contracture. In this group the adjacent facial nerve has been involved in the inflammatory process.

Group C. Herpes Oticus, with Facial Palsy and Hypo-acousis. In this group, with herpes oticus and facial palsy, there is an associated disturbance of hearing. This consists of a diminution of the acuity of audition with or without tinnitus aurium, and is a milder type of acoustic disturbance. It may be quite transient. It is to be ascribed to an extension of inflammatory products to the auditory nerve which is close by.

Group D. Herpes Oticus with Facial Palsy and Ménière's Complex. This is a very severe manifestation and has associated with the foregoing symptoms all the characteristics of Ménière's syndrome: tinnitus aurium, deafness, vertigo, nystagmus, vomiting, and disturbances of the equilibrium.

This group may also be explained by the extension of inflammatory products along the nerve sheaths to the terminations of the auditory nerve. (It is in my opinion very probable that the *ganglia* of the auditory nerve may be primarily involved in the specific inflammations of zona.)

REMARKS. The four groups of cases just outlined are all dependent upon specific herpetic inflammations of the geniculate ganglion, representing different degrees of severity. The eruption is confined to the geniculate ganglion zone; the other zoster zones of head and neck are free. The neural complications result from the proximity of the inflamed ganglion to the seventh and eighth nerves.

II. SUB-GROUPS OF THE SYNDROME. *Herpes Facialis with Facial Palsy and Acoustic Symptoms.* In this clinical type the eruption makes its appearance upon the face, an area represented by the Gasserian ganglion; the zoster zone of the geniculate is free. Facial palsy may be the sole neural complication, as in herpes oticus (Group B), or there may be associated disturbances of the auditory nerve.

Herpes Occipitocollaris, with Facial Palsy and Acoustic Symptoms. The herpetic eruption in this group is distributed over the occiput, the side of the neck, the inner surface and the posterior half of the outer surface of the auricle, and a patch corresponding to the angle of the jaw (herpes occipitocollaris). This skin area represents the zoster zones for the second, third, and fourth cervical ganglia. The zones for the geniculate and Gasserian ganglia are free. The neural complications do not differ from those described in the previous group.

Herpes Zoster of the Cephalic Extremity, with Auditory Complications. The occurrence of auditory complications in connection with herpes facialis, occipitocollaris, and herpes oticus, have already been mentioned. With the auditory symptoms there has been associated a peripheral facial paralysis. In my first paper this involvement of the auditory nerve was ascribed to an extension of the inflammatory process from the geniculate to the auditory nerve and its terminations, the envelopment of the facial, the nerve of Wrisberg, and the acoustic in a common sheath in the depths of the internal auditory canal favoring such an extension.

The great severity, however, of the acoustic disturbances in some of these cases, and their persistence, has suggested the thought that the acoustic ganglia themselves may be the seat of a primary inflammatory involvement (Fig. 2). It will be recalled that the cells of the ganglion of Scarpa and ganglion of Corti take their origin

from the neural ridge, an embryonic structure from which the other ganglia liable to zoster are derived. Clinical confirmation of this theory is found in the occurrence of acoustic symptoms in herpes zoster of the face, without an associated facial paralysis. In cases of this type, if the acoustic nerve were involved by reason of its proximity to the geniculate ganglion, the facial nerve could hardly escape a simultaneous involvement.

The following cases show that auditory symptoms may accompany herpes facialis and herpes oticus, without a corresponding facial palsy:

Casse.[2] Observation I. A typical herpes zoster of the third division of the fifth nerve, in a woman, aged fifty-eight years. Accompanying these manifestations in the trigeminal distribution,

FIG. 2.—The ganglia and terminations of the auditory nerve: 1, auditory nerve; 2, cochlear branch; 3, vestibular branch; 4, ganglion of Corti; 6, ganglion of Boettcher; 14, ganglion of Scarpa; 15, facial nerve. (Testut's Anatomy.)

there were pains in the auditory canal, *roaring in the ear*, and *diminution of hearing*. The face was not paralyzed. Two months later there was still tinnitus aurium and slight diminution of hearing. The examinations of the ear, throat, and nose were negative.

Burin-Desrozieres.[3] Observation II. A man, aged thirty-one years. Exposure to cold October 7, 1904, followed by neuralgic pain in the right side of the face; on October 14 an eruption of herpes zoster developed on the right side of the face. On October 18 the neuralgic pain had practically disappeared, but there persisted a certain "*hardness of hearing*" on the right side. Facial palsy was not observed.

[2] Zona de la troisième branche du trijumeau, Thèse de Paris, 1902.
[3] Ibid., 1904.

Gruber,[4] in recording two cases of herpes zoster, limited to the external auditory canal (herpes oticus), states: "In both cases there was hardness of hearing and tinnitus, which was out of proportion to the lesion in the external auditory canal. It would seem as if, in these cases, the auditory nerve was involved perhaps reflexly. The opening of the vesicles did not relieve the hearing, which only returned with the disappearance of the other symptoms."

It seems to me, therefore, very probable that the acoustic ganglia may be primarily involved in the specific inflammation of posterior poliomyelitis.

REMARKS. In the chief group of the syndrome, it will be observed that the eruption is situated in the geniculate area (herpes oticus). In the sub-group it is distributed, either in the zone of the Gasserian ganglion (herpes facialis), or in the zones of the upper cervical ganglia (herpes occipitocollaris). In all, the neural complications, if present, are identical in sequence and symptomatology. I would also emphasize the group with herpetic eruption and auditory symptoms, without facial palsy. These cases may depend upon a primary involvement of the ganglia of the acoustic nerve, as it would seem very improbable that an inflammation could extend from the geniculate to the auditory nerve, without at the same time compromising the facial. The possibility of slight or transient facial palsies escaping observation, must, however, be kept in mind.

In my previous paper I collected 60 cases of herpes zoster of the cephalic extremity, with facial palsy; in 19 of these cases auditory complications were also present. The eruption in this series of cases had the following distribution:

	Cases.
Herpes oticus	12
Herpes facialis	12
Herpes occipitocollaris	32
Herpes oticus and occipitocollaris (combined)	3
Herpes facialis and occipitocollaris (combined)	1

I would here remark that in the literature I found no recorded case of facial palsy and acoustic disturbance, complicating herpes zoster, in which the eruption was not situated on the cephalic extremity of the body. The question as to the occurrence of neural complications in herpes facialis and herpes occipitocollaris, the zoster zone for the geniculate being free from any eruption, I will consider under the next heading.

III. MULTIPLE INVOLVEMENT OE THE GANGLIA IN ZONA. Herpes zoster is an acute, specific, infectious disease, characterized by an inflammatory reaction in ganglia containing the so-called *spinal* or *unipolar type* of cells. Ganglia of this type are the spinal ganglia of the posterior roots, the Gasserian and geniculate ganglia of the

[4] Herpes Auricularis, Monatsech. f. Ohrenheilk., 1875, Nr. 5.

cranial nerves. The localization of a specific inflammatory process in the ganglia of the *spinal type* was termed Posterior Poliomyelitis by Head and Campbell, and the similarity of the pathological changes to those occurring in anterior poliomyelitis was pointed out. The fact was also emphasized that the essential pathological lesion is generally limited to a single ganglion, which corresponds to the eruption of zoster.

That more than one ganglion may be involved is shown clinically by the occurrence of double, triple, bilateral, and alternate forms of zona, the eruption appearing in more than one zoster zone. This tendency to involvement of more than one ganglion is especially frequent about the head and neck. I would call special attention to the fact that clinical evidence exists showing that some ganglia may be implicated in zona, without the occurrence of an eruption in their respective zones.

Symptoms indicating such involvement are to be found in the neuralgic pains and mild sensory disturbances (*hypalgesia* and *hypesthesia*) occasionally observed in zones adjacent to the chief or eruptive focus.[5] [6] It is also possible that the so-called vesicules aberrantes[7] may be regarded in the same light. In zona the ganglion which corresponds to the eruption is to be regarded as the chief or *eruptive focus*. The inflammatory reaction is not confined solely to this ganglion, but inflammatory changes of a milder grade may also be present in adjacent ganglia, above and below. In other words, there may be a serial involvement of ganglia, the extent and intensity of which depends upon the severity of the infection. Such a theory of inflammatory reaction in a chain of ganglia, which shades off from the chief or eruptive focus, is also more in harmony with the acute, specific, toxic nature of herpes zoster, and the analogy which it bears to the anterior poliomyelitis, the chief or eruptive focus of the one corresponding to the permanent paralytic focus of the other, while the transient and mild sensory manifestations of herpes are the sensory equivalent of mild and transient palsies. I attach a special importance to this inflammatory involvement of a series of ganglia, in the relation which it bears to the sub-groups of the syndrome—the *herpes facialis* and *herpes occipitocollaris* with neural complications.

The Gasserian, geniculate, and upper cervical ganglia may be regarded anatomically as representing a more or less continuous ganglionic chain. Hence, if the chief inflammatory or eruptive focus were situated in any one, a milder, non-eruptive, inflammatory reaction might occur in other ganglia of the group. In herpes zoster of the face, with neural complications, the chief or eruptive focus is

[5] Champion, Manifestation à distance dans la Zona, Thèse de Paris, 1900.

[6] Weisenburg, Herpetic Inflammation of the Cervical and Thoracic Nerves, Jour. Nerv. and Ment. Dis., 1907, p. 726.

[7] Tenneson, Vesicules aberrantes du zona, Bull. de la Soc. méd. des hôp., 1898.

situated in the Gasserian ganglion; there has, however, been a coincident inflammatory reaction in the geniculate, sufficient to disturb the function of the adjacent nerves, without producing an eruption in the geniculate area. In the same manner, I would explain those cases in which, with neural complications, the eruption is confined to the zones of the second, third, and fourth cervical ganglia.

The neural complications (seventh and eighth nerves) observed in herpes zoster of the cephalic extremity may, therefore, be regarded pathologically as depending upon an herpetic inflammation of the geniculate ganglion.

Pathological Evidences of Multiple Involvement of Ganglia. The elaborate pathological researches of Head and Campbell[8] are now so well known that I will consider this phase of the subject only in its relation to multiple or serial involvement of ganglia; and its bearing upon the existence of lesions of slight degree in ganglia near the chief or eruptive focus.

Histological studies in cases of zona show that the ganglion corresponding to the eruption is the seat of well-marked inflammation and hemorrhages. In the acute stage the ganglion is swollen and œdematous, and is the seat of extensive round-cell infiltration and hemorrhages; the cells are in various stages of degeneration; later, as the inflammation subsides, there is connective tissue proliferation, and in severe cases a permanent scar results. In both acute and chronic stages secondary changes are demonstrable in the corresponding posterior root, as well as in the peripheral nerves.

I will here briefly analyze the pathological evidence existing at the present time of serial ganglion involvement, which, in my opinion, furnishes a pathological basis for the mild sensory symptoms already mentioned as manifesting themselves in the adjacent non-eruptive zones.

In order to demonstrate the presence of a mild inflammatory reaction in ganglia adjacent to the chief or eruptive focus, quite recent cases would be the most favorable, if not essential. In the event of the process being older, such changes would be more readily demonstrable in the posterior roots than in the ganglia themselves.

In the descriptions of Head and Campbell it would appear that the inflammatory changes in zoster are limited to a single ganglion—that which corresponds to the eruption. Essentially this is true, although the presence of milder changes, if present, should receive due weight. Their statement as to multiple involvement is as follows: "It is probable that two ganglia are occasionally affected together. From clinical observation, this seems particularly liable to occur with the second, third, and fourth cervical. Unfortu-

[8] Pathology of Herpes Zoster, Brain, 1905.

nately, no such case is included in our series of postmortem examinations."

It will be observed, however, from the following abstracts of some of their observations, that mild pathological changes were noted in ganglia adjacent to the eruptive focus and yet apparently having no corresponding zoster manifestations.

CASE I.—Herpes zoster in first lumbar distribution of left side; three days duration. Left first lumbar ganglion—typical inflammatory changes present. Right first lumbar—*the cells do not stain well.* Left and right twelfth dorsal ganglia—*bloodvessels are much engorged.* Left and right second lumbar ganglia—neither show any *marked* change.

CASE IV.—Herpes zoster in twelfth dorsal distribution of right side; three days duration. Right twelfth dorsal ganglion—typical inflammatory changes present. Left twelfth dorsal—right and left eleventh dorsal were free from *noteworthy* alterations.

CASE V.—Herpes zoster, eleventh dorsal distribution of left side; fourteen days duration. Left eleventh dorsal ganglion—typical inflammatory changes were present; the remaining ganglia were normal. There were marked secondary degenerations in the posterior root of the eleventh dorsal on the left side. *A few definitely degenerated fibers were seen in the left twelfth dorsal root.*

CASE VI.—Herpes zoster in left third cervical distribution; fifty-seven days duration. In left third cervical ganglion and left third cervical posterior root the typical changes were present. *Some bundles of the fourth root on the left side also seemed to have undergone change, but this was a less certain change than that of the third root.*

CASE VII.—Herpes zoster in left second dorsal region; ninety-six days duration. Typical changes in left second dorsal ganglion and posterior root. *In first dorsal root a few degenerated fibers could be recognized.*

It will thus be seen that in Cases V, VI, and VII there were distinct, although slight, evidences of ganglionic changes, indicated by degenerations in the posterior root.

Pathological observations published since the appearance of their work are even more convincing. Ballet,[9] in a case of herpes zoster occipitocervicalis of three weeks' duration, reports as follows: "The ganglia were not examined; marked degenerations are present in the third cervical posterior root. In the second cervical root it is with difficulty that degenerations are found, although they are distinctly present."

Armand-Delille and Camus,[10] in a case of herpes occipitocollaris of one month's duration, found marked chromatolysis in the cells

[9] Lesions nerveuses dans un cas de zona cervicale, Soc. des hôp., 1900, p. 706.
[10] Soc. de neur. de Paris, February, 1903.

of the left third cervical ganglion. Similar cellular degenerations were also present in the left second cervical ganglia, but less marked. There were corresponding degenerations in the second and third posterior roots. (This case is of especial interest pathologically, in that the ganglionic lesion was a cellular degeneration without the massive inflammatory reactions usually found.)

In a personal observation of herpes occipitocollaris with facial palsy—autopsy eighty-seven days after the appearance of the eruption—there were found well-marked degenerative changes not only in the third cervical posterior root, but also in the posterior root of the geniculate ganglion, the *pars intermedia* of Wrisberg.[11]

A most interesting observation is that of Hedinger.[12] A herpes zoster in the eleventh dorsal distribution of the left side; death occurred nineteen days after the appearance of the eruption. There was typical hemorrhagic inflammation in the left eleventh dorsal ganglion; in the left tenth and left twelfth dorsal ganglia similar changes are present, but much less severe. All the lumbar ganglia on the left side showed lymphocytic infiltration, diminishing in intensity downward, but especially well marked in the last lumbar. In the right lumbar ganglia only slight and insignificant changes were present. Similar changes were present and somewhat more marked in the right eleventh and twelfth dorsal ganglia.

In this case there seems to be no doubt as to the effect of the specific toxin of herpes zoster on a series of ganglia, although the eruptive manifestations were limited to the eleventh dorsal zoster zone. It will thus be apparent, from the more recent pathological studies of herpes zoster, that the inflammatory reaction in the ganglia is not so limited in its extent as a study of the eruption phenomena alone might lead us to infer, in this respect confirming the clinical observation of mild sensory disturbances—neuralgic pains, hypalgesia, hypesthesia—in zones free from the eruption, and also explaining the occurrence of facial palsy in herpes zoster of the face and neck, in which the geniculate zone is free from eruption.

IV. The Cranial Nerve Ganglia and Their Relation to Herpes Zoster. I will now mention, briefly, certain facts relating to the anatomy and histology of the cranial nerve ganglia, and the probable role which these structures play in herpes zoster.

At the time of the presentation of my paper, June, 1906, the only recognized cranial nerve localization of zoster was that of the Gasserian ganglion, an inflammation of this ganglion giving rise to the well-known herpes facialis, concerning which, an abundant literature has grown up. Barnes,[13] however, in 1903, in the report of a case of herpes of the neck associated with facial palsy, made the following statement: "Hence this association of symptoms

[11] Jour. of Nerv. and Ment. Dis., February, 1907.
[12] Deut. Zeit. f. Nervenheil., Band xxiv, S. 305.
[13] Trans. Clin. Soc., 1903, vol. xxxvi.

strongly suggests that the patient is suffering from the effects of an inflammation of three ganglia—one motor (the geniculate of the facial nerve) and two sensory (the third and fourth right cervical root ganglia)."

Vail[14] also, in his paper on herpes zoster auris, mentions the otic ganglion as a possible localization, in the following words: "Politzer and others have observed facial paralysis on the affected side. This would seem to indicate involvement of the otic ganglion, which I believe has a branch of the facial entering it."

The otic ganglion, or ganglion of Arnold, is not regarded by histologists as belonging to the spinal type. It is grouped with the sympathetic system of ganglia, in which the cell type is multipolar, and not unipolar. Therefore, according to the present pathological conceptions of the disease, it should be excluded from the realm of herpes zoster.

As regards the geniculate ganglion, it must be emphasized that this structure is not *motor;* histologically it belongs to the sensory ganglia, composed of the *unipolar* type of cells, and is, therefore, the homologue of the spinal and Gasserian ganglia. With its afferent fibers, the pars intermedia of Wrisberg, and its efferent fibers, the petrosal nerves, it forms the sensory system of the facial nerve. In other words, we have here a ganglionic structure manifesting the same susceptibility to zona as the Gasserian and spinal ganglia.

If the Gasserian and geniculate ganglia, by virtue of the unipolar cell type, belong to that series of ganglia liable to the inflammation of zona, the same would also be true of the ganglia of the glossopharyngeal nerve (ganglion of Andersch and ganglion of Ehrenritter) and of the vagus nerve (ganglion jugulare and ganglion plexiforme). These ganglia are also regarded by histologists as belonging to the *unipolar* or *spinal type,* and therefore cannot be excluded from the realm of herpes zoster.

I would also lay especial emphasis upon the possible role played by the ganglia of the acoustic nerve in this affection. All the posterior spinal ganglia, as well as the ganglia of the fifth, seventh (geniculate), ninth, and tenth cranial nerves, are developed from outgrowths of the embryonic structure known as the neural ridge. These ganglia are all of the so-called unipolar or spinal type. The ganglion of the acoustic nerve (ganglion acousticum) is also an outgrowth of the neural ridge, later becoming differentiated into the ganglion spirale of the cochlear nerve and the ganglion of Scarpa of the vestibular nerve. The cells of the acoustic ganglia are not, however, unipolar, but retain the primitive bipolar character (in fishes the cells of the spinal ganglia are bipolar, and it is only in higher types that the unipolar cells are found).

[14] Laryngology and Rhinology, 1906.

While the ganglia of the auditory nerve retain their bipolar character, their original source is the neural ridge, and it would appear very probable that they, as well as the other ganglia taking their origin from this structure, may be liable to the specific action of the toxin of zoster. This theory is confirmed clinically by the occurrence of very severe auditory nerve symptoms in zona of the face, ear, and neck. From the developmental and histological standpoint, I believe that we are justified in receiving the ganglia of the glossopharyngeal, vagus, and acoustic nerves into the realm of herpes zoster.

V. The Zoster Zone for the Geniculate Ganglion (Herpes Oticus). In order to determine the exact extent and boundary of this zoster zone, accurate clinical observations in the future will be necessary—observations in which the whole extent of the eruption has been carefully noted and indicated on the various anatomical landmarks of the ear. There are, however, at the present time a sufficient number of accurately recorded cases of herpes oticus, by means of which a fair idea of the extent and probable boundaries of this zone may be determined, and which may serve as a basis for future investigations. The difficulties encountered in the interpretation of this area are considerably increased by the very complex innervation of the parts and the tendency to variation and overlapping of the zoster zones on the extremities of the body. It will also be recalled that the zones of the Gasserian and cervical ganglia are partially represented on the auricle, the herpes occipitocollaris encroaching on the auricle posteriorly, and the herpes facialis anteriorly. The zone for the geniculate is intercalated between these two areas. For the purpose of determining this zone, I have analyzed and tabulated seventeen cases of primary isolated herpes zoster oticus. It is, however, only the area in which the eruption is distributed to which I will call attention. This distribution corresponds in extent to the following anatomical landmarks: The tympanic membrane, the external auditory canal and meatus, the concha, tragus, antitragus, lobe of the ear (external surface), anthelix, and the fossa of the anthelix.

We may, therefore, assume that the geniculate ganglion is represented in an irregularly cone-shaped area, the apex corresponding to the tympanic membrane, the base situated on the external surface of the auricle. I do not believe that this entire area is represented by the geniculate ganglion alone. Allowance must be made for the overlapping of the Gasserian in front, and the cervical nerves behind. It is in my opinion, also, not improbable that future investigations will show that the ganglia of the glossopharyngeal and vagus nerves are also partially represented in this area.

CASES OF HERPES OTICUS.	THE DISTRIBUTION OF THE ERUPTION ON THE ANATOMICAL LANDMARKS OF THE EAR BY ×.											
	Auricle.	Antihelix.	Fossa of helix.	Lobe.	Tragus.	Antitragus.	Concha.	External meatus.	External auditory canal.	Anterior wall.	Posterior wall.	Tympanum.
1. Berger, Neur. Central, 1905	×	..	..	..	..	..	..	..	×			
2. Chavanne (Bilateral case). *Right*	..	×	..	..	..	×	×					
3. Ann. Mal. de L'Oreille, 1906. *Left*	..	..	..	..	..	×	..	×				
4. Gruber. Case 1	..	..	..	..	..	..	..	..	..	×	..	×
5. Monatsschr. f. Ohrenheil., 1875. Case 2	..	..	..	..	..	..	..	×	..	..	×	
6. Gruber, Zeitsch. f. Ohrenheil., vol. xlvi	..	×	..	..	..	..	×	×				
7. Hasslauer, Deut. Mil. Aerzt. Zeit., 1905	×	..	..	..	×	..	..	..	×			
8. Hammerschlag, Arch. f. Ohrenheil., 1901	..	..	×	×	×							
9. Hammerschlag, Arch. f. Ohrenheil., 1898	..	..	×	×	×							
10. Sommers, Amer. Med. and Surg. Bull., 1896	..	..	..	..	..	..	..	×	×			
11. Seraï, Zeit. f. Ohrenheil., vol. xlvi	..	..	..	..	..	..	×					
12. Szenes, Inter. Central. f. Ohrenheil., 1902	..	..	..	..	..	..	..	..	..	..	..	×
13. Tomka, Arch. f. Ohrenheil., 1900	×											
14. J. R. Hunt, Jour. Nerv. and Ment. Dis., 1907	..	..	..	..	..	..	×	×				
15. Personal Observation	..	×	..	..	..	..	×	..	..	..	..	×
16. Personal Observation	..	..	..	×	×	×	×	×	..	..	..	×
17. Personal Observation	..	..	..	..	×	..	×	×				

VI. SENSORY SYMPTOMS IN THE TRIGEMINAL AND CERVICAL ZONES IN HERPES ZOSTER OTICUS. In some cases of herpes zoster oticus, symptoms referable to the trigeminal distribution have been noted. Tearing and shooting pains in one or more of the three divisions of the fifth nerve are mentioned (Hasslauer,[15] Anstie,[16] Hammerschlag[17]). The points of exit of the trigeminus were found tender on pressure (Berger[18] and Hammerschlag). Diminution or absence of the corneal and conjunctival reflexes (Berger, Hammerschlag, Ramsay Hunt[19]), hypesthesia and hypalgesia of the face on the affected side have been observed. These fifth nerve symptoms are sensory in nature, and unaccompanied by a corresponding eruption of herpes.

I find an explanation for their presence in a mild inflammatory reaction of the Gasserian ganglion, but not of sufficient severity to produce the eruption. It must be admitted, however, that the neural connection between the geniculate ganglion and the second and third divisions of the fifth nerve (great and small superficial petrosal nerves) may give rise to a referred pain.

Mild sensory symptoms of a similar nature may, likewise, be

[15] Deut. Mil.-Aerzt. Zeit., 1905, vol. xxxv.
[16] The Practitioner, 1871, p. 198.
[17] Arch. f. Ohrenheil., 1901, s. 16; 1898, s. 1.
[18] Neur. Centralblatt, 1905, s. 844.
[19] Jour. of Nerv. and Ment. Dis., 1907.

present in the distribution of the cervical nerves in cases of herpes oticus. In one of my cases a typical example of herpetic inflammation of the geniculate ganglion, with herpes zoster oticus, facial palsy, and deafness, severe lancinations were present in the occipital region and neck for several days. In addition there were distinct hypalgesia and hypesthesia on the left side of the face, head, and neck for two weeks. This sensory disturbance was not present below the level of the neck, and there were no stigmata of hysteria.

VII. The Ganglia of the Glossopharyngeal and Vagus Nerves and Their Probable Role in Zoster. These ganglia, composed of unipolar cells, taking their origin from the neural ridge,

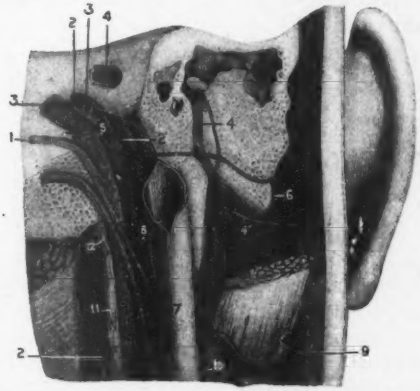

Fig. 3.—The ganglia of the ninth and tenth nerves, and the auricular branch of the vagus: 1, spinal accessory nerve; 2, glossopharyngeal; 2′, ganglion of Andersch; 3, vagus nerve; 3′, ganglion jugulare; 4, facial; 4′, auricular branch of facial; 5, auricular branch of vagus; 6, anastomosis between the auricular branches of the facial and vagus nerves. (Testut's Anatomy.)

are the homologues of the posterior spinal ganglia (Fig. 3). Theoretically there is no reason why they should not be involved in cases of posterior poliomyelitis. From our knowledge gained by the dissection method alone, the ganglia of the vagus presumably have a skin representation on the posterior wall of the auditory canal, the posterior portion of the tympanic membrane, concha, and posteromesial surface of the auricle (*auricular branch of the vagus*). The glossopharyngeal ganglia through their communications with the vagus and facial nerves may also be represented in the same area. In an analysis of many cases of zona of the cephalic extremity, I have had constantly in mind the possibility of symptoms which might be ascribed to a disturbance of the vagus function. The following case, reported by Buys[20] is the only one coming under my notice, which might bear this interpretation:

[20] Bull. de la Soc. Belge d'otol., de laryng. et de rhin., 1898. Eruption herpetique du pavillon precedé de phenomenes nerveux considerables.

"A girl, aged seventeen years. Onset with headache and vomiting. Severe headaches continued with *stiffness of the neck*, and *frequent vomiting*. Photophobia, no fever or delirium. *The pulse was slow and irregular*. On the fourth day, the acuteness of the pain subsided and settled in the mastoid region of the right side. The mastoid was tender, as was the canal on the introduction of the otoscope. Hearing was diminished. On the fifth day herpetic vesicles made their appearance on the antitragus and lobule of the ear. The headache and neck pains are less severe. On the sixth day a fresh crop of vesicles made their appearance on the mesial surface of the pinna and the lobule. All pain disappeared in the course of a few days, and the hearing was restored. In fifteen days, the eruption had vanished."

The frequent vomiting and the slow irregular pulse in this case are strongly suggestive of a vagus disturbance. I would also emphasize the area of distribution of the eruption corresponding to the cutaneous filaments of the vagus. It will also be observed, in this case, that the hearing was affected, without any associated evidences of facial palsy, also suggesting a primary involvement of the acoustic ganglia.[20]

VIII. Concluding Remarks. The fusion of these clinical types into a single large group, with a common pathological basis, constitutes a well-defined clinical entity. It may be summarized as follows: A peripheral facial palsy complicating an eruption of herpes zoster on the cephalic extremity of the body. The eruption may be limited to the face, the head and neck, or the ear, or combinations of these (*herpes facialis, herpes occipitocollaris, herpes oticus*). The term herpes oticus I would confine to that group of cases in which the eruption is restricted to the cone-shaped zoster zone of the geniculate ganglion (the tympanum, auditory canal, concha, and an adjacent marginal area on the external surface of the auricle). With the facial palsy there may be associated symptoms referable to the auditory nerve. These are of two types—hypo-acousis merely, or a severe complex of symptoms similar to Ménière's syndrome, consisting of tinnitus aurium, deafness, vertigo, vomiting, nystagmus, and disturbances of equilibrium.

The underlying pathology is the posterior poliomyelitis, a specific inflammation of ganglia of the spinal type. The characteristic features are given to this chapter of zona by the proximity of the geniculate ganglion to the facial and the terminal divisions of the auditory nerve, the inflammation in the geniculate ganglion extending to the adjacent nerve trunks by contiguity of structure. The pressure effects would be still further increased by the enclosure of these structures in a common sheath, situated in a narrow osseous canal.

I also believe that the ganglia of the acoustic nerve may be primarily involved, and I have given embryonal, histological, and

clinical grounds for advancing this theory. I have also suggested the possibility of the ganglia of the glossopharyngeal and vagus nerves playing a role in the symptomatology of the syndrome, and emphasized the great importance, clinically, of vagus symptoms in this relation.

A particular emphasis has also been given to the occurrence of mild inflammatory reactions in ganglia above or below the chief focus, or that giving rise to the eruption of herpes zoster (*eruptive focus*). The symptoms present in the non-eruptive zones are mild and transitory in nature, and consist of pains and slight objective sensory disturbances. I regard the Gasserian, geniculate, acoustic, glossopharyngeal, vagus, second, third, and fourth cervical ganglia as representing a continuous ganglionic series or chain, all having the same embryonal origin (*neural ridge*), and all, with the exception of the acoustic ganglia, having the same cell type (unipolar), and therefore belonging to the realm of posterior poliomyelitis. This serial chain of ganglia is concerned in the production of the syndrome. A hemorrhagic inflammation in one of these ganglia is followed by the usual manifestation of herpes zoster, an eruption appearing in its respective zone.

Depending upon the severity of the infection, other ganglia of the group may be the seat of an inflammatory reaction as well, but not sufficient in degree to produce an eruption. This milder involvement is manifested clinically by pains and slight objective sensory disturbances, and in the case of the geniculate and acoustic ganglia, by their respective neural symptoms.

THE PRESENT STATUS OF EXPERIMENTAL ARTERIAL DISEASE.[1]

By I. Adler, M.D.,
of New York.

For a long time the problems, both clinical and pathological, involved in the question of arteriosclerosis have received considerable attention on the part of the investigator, the clinician, and the practitioner. The saying that "a man is as old as his arteries" has become public property, not only of the medical, but also of the lay world, and passes almost as an axiom today.

An enormous literature has sprung up on arteriosclerosis, and it has been attacked by many brilliant and indefatigable workers from the clinical and histological as well as from the experimental

[1] Read at a meeting of the New York Academy of Medicine, March 19, 1908.

side, without, however, it must be confessed, any unanimity of view or clearness of conception being attained. It was, therefore, hailed by many as the beginning of a new era in the study of arteriosclerosis when Josué,[2] in 1903, reported that he had artificially produced arteriosclerosis, or, as he called it, "atheroma," in the aorta of rabbits by intravenous injections of adrenalin. The matter was at once taken up by investigators in many countries. Erb,[3] Külbs,[4] Kurt Ziegler,[5] v. Rzentkowski,[6] Fischer,[7] Scheidemantel,[8] D'Amato,[9] Pearce and Stanton,[10] Lissauer[11], Baylac and Albarede,[12] Biland,[13] and others have in the main verified and somewhat added to Josué's results

The lesions thus produced are very characteristic, and on superficial view seem to resemble closely atheromatous degeneration in the human aorta. Their site of predilection is the ascending portion and the arch of the aorta; in more advanced cases the descending portion is involved. The abdominal aorta is the last to suffer, and extensive lesions there are rather exceptional. A few cases, however, have been reported in which the entire aorta from its origin down into the iliacs has been converted into a rigid tube of degeneration.

The lesions appear as larger or smaller patches of peculiar translucent appearance and rough surface; in the advanced stages the edges are somewhat raised above the level of the inner surface of the vessel, while the centre is usually depressed; the vascular walls are distinctly thinner than normal in and about these patches, and thus tend to the formation of aneurysmatic dilatations and pouches. It should be noted that the aneurysmatic dilatation never involves the entire circumference of the vessel, but is a partial bulging corresponding to the location of more or less intensely degenerated patches. Erb, Fischer, and Ziegler have noted cases of dissecting aneurysm. As a rule, calcification appears at a very early stage of the process.

[2] Atherome aortique expérimentale, Presse médicale, 1903, 1904, p. 798.

[3] Experimentelle und histologische Studien über Arterienerkrankung nach Adrenalininjektionen. Arch. f. exp. Path. u. Pharm. 1905, liii, 173.

[4] Experimentelle Studien über die Wirkung der Nebennierenextrakte. Arch. f. exp. Path. u. Pharm., 1905, liii, 140.

[5] Ueber die Wirkung intravenöser Adrenalininjektionen auf das Gefäss-system und ihre Beziehung zur Arteriosklerose. Ziegler's Beiträge, 1905, xxxviii, 229.

[6] Atheromatosis aortæ bei Kaninchen nach intravenösen Adrenalininjektionen. Berl. klin. Woch., 1904, 830.

[7] Ueber Arterienerkrankungen nach Adrenalininjektionen. Kongress f. innere Medizin, 1905, 236.

[8] Ueber die durch Adrenalininjektionen zu ersengende Aortenverkalkung der Kaninchen. Virchow's Arch., 1905, clxxxi, 363.

[9] Weitere Untersuchungen über die von den Nebennieren Extrakten bewirkten Veränderungen der Blutgefässe und anderer Organe. Berl. klin. Woch., 1906, Nrs. 33, 34.

[10] Experimental Arteriosclerosis. Jour. Exper. Med., 1906, viii, 74.

[11] Experimentelle Arterienerkrankungen beim Kaninchen. Berl. klin. Woch., 1905, p. 675.

[12] Recherches expérimentales sur l'atherome de l'aorte consécutif a l'action de l'adrenaline. Compt. rend. de la soc. de biol., 1904, lvii, 640.

[13] Ueber die durch Nebennieren praparate gesetzten Gefäss und Organveränderungen. Deut. Arch. f. klin. Med., 1906, lxxxvii, 1906, p. 413.

The yellow patches of fatty degeneration and the so-called gelatinous patches, so frequent and constant in human atheroma, have, so far as I know, never been found in these experimental affections of the rabbit's aorta, nor do the patches just described ever seem to lead to ulceration.

Almost all investigators have found these lesions confined to the aorta, no matter how long the animals have been subjected to treatment. Erb, it is true, reports some lesions in other vessels, iliacs and carotids, but no other observer has been fortunate enough to meet with similar results. Once or twice slight degeneration of the pulmonary artery has been noted. The fact that many rabbits subjected to intravenous injections of adrenalin die very suddenly of cerebral hemorrhage suggests the strong probability of damage to the smaller cerebral vessels, but as yet no one has been able to detect any palpable lesions.

All observers are pretty well agreed on the histology of these lesions. The degeneration is primarily and mainly located in the media. The first change that occurs is necrosis of the smooth muscle cells, and as they are destroyed, the elastic fibers, deprived of the support of the muscle cells and no longer able alone to withstand the pressure, are first stretched to their utmost limit and then snapped and broken. There is still some doubt whether the elastic fibers themselves degenerate, although it is probable that, together with the tension and the metabolic changes going on within the vessel wall, some fatty degeneration of the elastic fibers does take place. Calcareous deposits very soon appear within the areas of necrotic and destroyed cells and fibers. No inflammatory process can be observed during all these changes. Leukocytic emigration in the outskirts of the patch, with an occasional giant cell, is occasionally seen, but only after calcification is complete or nearly so. The whole is distinctly a necrotic and not an inflammatory process, and is in the main strictly confined to the media. The intima seems not to be largely involved. In those places where considerable depression occurs together with distention of the vessel wall, some hypertrophy of the intima takes place, but degeneration or ulceration of the intima has not been observed.

It was very soon found that the suprarenal extracts—adrenalin, suprarenin, perinephrin, and others—were not the only substances that produce the peculiar effects in the aorta of rabbits. A number of other substances that tend to raise blood pressure produced the same results. Fischer obtained positive results with digalen, Miller[14] with barium chloride, Bennecke[15] with barium chloride, hydrastin, and hydrastinin, Sturli[16] with methylamino-acetobrenzkatechin,

[14] Experimental Arterial Degeneration. Amer. Jour. Med. Sci., 1907, p. 593.

[15] Studien über Gefässerkrankungen durch Gifte. Virchow's Arch., 1908, cxci, 202.

[16] Gefässveränderungen nach Injektionen von Methylamino-acetobrenzkatechin. Münch. med. Woch., 1905, 630.

which is also a vasoconstrictor and pressure raiser. Some years ago I[17] fed tobacco infusion to rabbits, with a view of testing the effect on the bloodvessels. Interesting changes in the liver and in the smallest vessels were found, but none in the aorta. After the appearance of Josué's paper, in association with Dr. Hensel,[18] I injected pure nicotine, also a decided blood pressure raiser, into the ear vein of rabbits, with positive results. Miller also obtained positive results with nicotine. Boveri[19] obtained positive results with infusion of tobacco by the mouth. Gouget[20] treated rabbits with infusion of tobacco by the mouth and intravenously and with a combination of both. Baylac[21] obtained positive results by intravenous as well as by subcutaneous administration of tobacco infusion. Quite recently Rickett[22] evidently unaware of our experiments, obtained positive results with nicotine and with infusion of tobacco intravenously.

All the substances mentioned thus far have one quality in common —they are more or less decided raisers of blood pressure; and the conclusion naturally suggests itself that the effect obtained is produced by the blood-pressure-raising quality of the drugs employed. This fits in very nicely, too, with the prevailing theories of human arteriosclerosis, and many authors build far-reaching theories and hypotheses on this basis. A closer scrutiny of the facts shows this view, however, to be untenable.

Mironescu[23] experimenting with euphthalmin, which is said to depress blood pressure as violently and suddenly as adrenalin raises it, comes to the conclusion that it is not the rise in blood pressure, but the sudden variations in pressure that produce the effect. D'Amato experimented with paraganglin, which, as he proved by manometric tests, does not raise the blood pressure. The paraganglin was given intravenously as well as by the mouth, and he obtained results similar to those with adrenalin. When given by the mouth it was necessary to employ much larger doses. D'Amato is inclined to look upon the action as purely toxic, and claims a special affinity of paraganglin for the smooth muscle, he having found slight degrees of necrosis in the muscles of the stomach and intestine, as also in the bladder, when given by the mouth. Braun[24] gave amyl

[17] Some Effects of Tobacco on the Tissues of Rabbits. Jour. Med. Research, viii, No. 2.

[18] Intravenous Injections of Nicotine and Their Effects upon the Aorta of Rabbits. Jour. Med. Research, September, 1906, v, No. 2.

[19] Contributo allo Studio degli Atheromi aortici sperimentali. Clinica med. Ital., 1906, xlv, 41.

[20] Sur quelques lésions de l'intoxication tabagique expérimentale. Presse méd., 1906, No. 67, 533.

[21] Athérome expérimental de l'aorte consécutif a l'action du tabac. Compt. rend. de la Soc. de biol., 1906, lx, 935.

[22] Experimental Atheroma. Jour. Path. and Bact., October, 1907, xii, No. 1.

[23] Beiträge zur Wirkung des Adrenalins und Euphthalmins auf den Blutdruck beim Kaninchen. Zntralbl. f. innere Med., 1906, 598.

[24] Zur Frage der Arteriosklerose nach intravenöser Adrenalinzufuhr. Münch. med. Woch., 1905, p. 533.

nitrite and adrenalin together intravenously and obtained positive results, though he had shown by careful manometric measurements that this combination does not alter the blood pressure; he is, therefore, convinced that the positive results obtained were caused by toxic action. Fischer obtained positive results with a great variety of substances, a large number of which, such as acids, ferments, and even normal saline, had little or no effect upon blood pressure. Kolisch[25] claims positive results with phloridzin and phloretin, both of which are said to have no effect on blood pressure. Boveri injected carbonate of lead in physiological salt solution in three rabbits, and found dilatations, thickenings, calcifications, and aneurysms. He also experimented on 6 rabbits with putrid material, partly through a stomach tube and partly subcutaneously, obtaining positive results in three, while the other three showed no lesions. Fischer writes that he has produced aneurysms without calcification and with but very little change apparent to the naked eye in rabbits by the injection of various metallic salts. (I have been unable to find any detailed account of these experiments.) It might be mentioned in this connection that Koranyi[26] claimed that iodine, especially in the form of iodipine, inhibited the action of adrenalin on the rabbit's aorta. As this seemed to supply an experimental basis for the popular treatment of arteriosclerosis, it created quite a sensation. It was tested by many, especially by Loeb and Fleisher[27] who, after very careful experiments on a large number of rabbits, could find no palpable influence of the iodides upon the action of adrenalin. This seems now to be the general opinion. In a later publication Koranyi[28] claims that it is not the iodine, but the oil, which tends to neutralize the effect of the adrenalin.

Morelli[29] a pupil of Koranyi, working with digalen, finds that sesame oil prevents its action upon the rabbit's aorta. According to Bennecke, spermin counteracts to some extent the action of hydrastinine. On the other hand, Hedinger and Loeb[30] encountered the typical aortic lesions in rabbits treated with subcutaneous injections of KI, but all their further experiments with the iodides proved negative. We should mention also the work of Loeb and Githens[31] concerning the effect of intravenous injections of adrenalin

[25] Ueber durch Phloridzin hervorgerufene Aortenveränderungen. Münch. med. Woch., 1905, p. 2446.

[26] Ueber die Wirkung des Iods auf die durch Adrenalin erzeugte Arterionekrose. Deutsch. med. Woch., 1906, Nr. 17.

[27] Ueber den Einfluss von Iodpräparaten auf die durch Adrenalininjektionen hervorgerufenen Gefässveranderungen. Deutsch. med. Woch, 1907, Nr. 10, 382,.

[28] Berichtigung su meiner Mitteilung über die Wirkung des Iods auf die durch Adrenalin-erzeugte Arterionekrose. Deutsch. med. Woch., 1907, Nr. 5.

[29] Ueber Arterionekrose. Berl. klin. Woch., 1908, Nr. 8, 398.

[30] Ueber aortenveränderungen bei Kaninchen nach subkutaner Iodkaliverabreichung. Arch. f. exp. Path., 1907, lvi, 314.

[31] The Effect of Experimental Conditions on the Vascular Lesions Produced by Adrenalin. Amer. Jour. Med. Sci., October, 1905, 403.

in rabbits with experimental nephritis, in others after thyroidectomy, and in pregnant animals, with a view of testing the effect of these injections both on the mother and on the developing bloodvessels of the fœtus. They also studied the effect of pyrokatechin.

We have thus a rather large group of substances, some tending to raise blood pressure, some having no effect at all upon it, some few even lowering it, but all producing very similar, it may be said practically identical, effects upon the aorta of rabbits. They all primarily affect only the media, causing necrosis with degeneration and calcification of the smooth muscle fibers, stretching and breaking up of the elastic fibers, and, when the intima is at all affected, it is simply in the form of more or less secondary and compensatory thickening, never associated with any degeneration or ulceration, the entire process resembling that described by Mönckeberg[32] in human peripheral vessels.

In order to arrive at a just valuation of these experimental results a number of other facts must be noted. In the first place, it must be stated that the lesions described have been obtained only in rabbits. All efforts to produce similar affections in other animals, as dogs (Pearce and Stanton, Fischer, v. Rzentkowski, and others) and monkeys (Erb), have utterly failed. Even in rabbits, however, there is apparently no constancy or regularity in the effect, and it is impossible to predict the result of any experiment, no matter what substance is used.

Kaiserling[33] experimented on 8 rabbits with adrenalin, one of which received as many as 66 injections, with absolutely no macroscopically visible lesions, and under the microscope nothing was to be seen except a slight stretching of the elastic fibers.

It is to be regretted that many observers give no details of their experiments, but all that do, report a varying number of negative as well as positive results. Again, it is generally recognized that the positive results obtained are very frequently in no proportion to the number of injections or to the duration of the experiment. Erb has seen extensive calcification of the entire aorta down to the iliacs after one single injection of adrenalin. It is a common experience to have extensive calcareous patches after but comparatively few injections, and no lesions after numerous injections and prolonged treatment. Adler and Hensel found calcification and aneurysms after only 18 injections of nicotine, and no gross lesions whatsoever after as many as 117 nicotine injections.

Josué called attention to the fact that the age and weight of the rabbit are important factors; that the results are more likely to be positive in old animals than in young ones. This seems, on the

[32] Ueber die reine Mediaverkalkung der Extremitätenarterien und ihr Verhalten zur Arteriosklerose. Virchow's Arch., 1903, clxxi, 141.

[33] Beiträge zur Wirkung intravenoser Suprarenininjektionen auf die Kaninchenaorta. Berl. klin. Woch., 1907, Nr. 2, 29.

whole, to be borne out by the results of subsequent research. Pic and Bonnamour[34] injected two young rabbits, weighing under 2000 grams for three months with adrenalin, with no visible effect. Older and heavier animals weighing over 2000 grams gave positive results after a comparatively short time. They found too, that rabbits artificially made tuberculous, or whose power of resistance was impaired, for example, by lactation, responded more readily to adrenalin. Their experiments, however, are too few in number to be convincing. Fischer, however, arrives at similar conclusions.

On the other hand, there are reports of old animals showing nothing, and of young animals with positive results. Thus, Kurt Ziegler found calcareous patches in the abdominal and thoracic aorta with aneurysmatic dilatation in a rabbit only eight weeks old that had been injected only for ten days, while an old animal that had been injected with adrenalin intravenously for six and a half months and subcutaneously for another three and a half months, the entire experiment lasting ten months, showed no gross lesions and but very slight microscopic changes.

In view of these irregular and contradictory results, the question suggested itself to many investigators: Are we really producing an experimental effect by our intravenous and subcutaneous injections? Is it not possible, nay, even probable, that our so-called positive results are the natural outcome of spontaneous disease of the rabbit, and have no relation whatever to our experimental treatment?

It is beyond doubt that arterial disease does occur spontaneously in animals. Lyding,[35] for instance, finds in the ox and in the horse aortic disease very much like human arteriosclerosis, and in the dog a condition in many respects similar to the lesions in the rabbit's aorta. The necessity for investigating this question in the rabbit is obvious. Hedinger and Loeb examined about 100 rabbits that had not been used for experimental purposes, but could find no gross aortic lesions. Von Rzentkowski examined 10 rabbits, with the same negative result; Adler and Hensel, 14 rabbits, all fully grown, some of them old and all weighing over 2000 grams, without being able to detect any macroscopic lesions in the aorta. Fischer states positively that he has found in a number of rabbits (he gives no figures), especially in such as have died from some form of cachectic disease, spontaneous aortic lesions exactly identical, macroscopically and microscopically with those found after adrenalin injections. Bennecke examined 400 rabbits not used for experiment, and found typical aortic lesions of various degrees of intensity in 12 (3 per cent). Quite recently Amy B. Miles[36] published some very startling

[34] Contribution a l'étude du determinisme de l'atherome aortique experimental. Soc. de Biol., 1905, 219.

[35] Zur Kentniss der Arteriosklerose bei Hausthieren. Zeits. f. Thiermed., Band ii, p. 359.

[36] Spontaneous Arterial Degeneration in Rabbits. Jour. Amer. Med. Assoc., October 5, 1907, p. 1173.

figures: 61 rabbits were treated with intravenous injections of adrenalin; of these, only 17 (27.86 per cent.) showed macroscopically visible lesions. Of 49 normal rabbits obtained from the same source, kept under the same conditions, and not experimented upon, 17 (34.77 per cent) showed macroscopic lesions. (Nothing is mentioned concerning age and weight of the animals.) The lesions in both sets were identical and of the usual type. When one considers the many thousands of rabbits that have been used for experiment and dissection, it is certainly astonishing, in the light of the statistics of Dr. Miles, that spontaneous aortic disease has not more often been encountered before this. Possibly these lesions may frequently have been overlooked, no special attention being paid to the condition of the vascular system. It is highly probable that breed, environment, food, age, and general condition are important and insufficiently studied factors concerned in the development of spontaneous aortic lesions in the rabbit. That, however, aortic lesions do occur spontaneously in rabbits, and more often than one would have imagined, seems certain.

The experiments dealing with bacteria and their toxins had best be grouped into a separate class. They are as yet but few in number, but promise, if continued, most valuable results. The changes found in the rabbit's aorta in most of these experiments are said to be different from the adrenalin type, and to resemble more nearly human arteriosclerosis. Thus Gilbert and Lion[37] as early as 1889, injected typhoid bacilli into the ear vein of a rabbit whose aorta had previously been injured. They found at the place of injury a plaque surrounded by a zone of inflammatory material involving both the intima and the media, with a central depression and calcification, particularly in the media. In another rabbit whose aorta had not been injured, injected with a malignant bacillus isolated from man, they found also a plaque in the aorta, but no calcification; there was a distinct hyperplasia of the intima almost purely of connective tissue. They state distinctly that in location, in gross appearance, and in histological structure it approached very closely the arteriosclerosis of the human aorta, and they consider their experiments a proof that infectious disease may be the cause of arteriosclerosis. O. Klotz,[38] besides experimenting with adrenalin under various conditions, and in the main verifying the results of others, obtained important results with the typhoid bacillus and the streptococcus. These, injected into the ear vein of rabbits, seemed to produce changes in the aorta and *in the pulmonary artery* closely resembling the conditions found in arteriosclerosis of the human aorta. There were no aneurysms and no calcification, but fatty degeneration of the endothelial cells

[37] Arterites infectieuses expérimentales. Compt. rend. Soc. de Biol., 1889, p. 583.

[38] A Discussion on the Classification and Experimental Production of Arteriosclerosis. Brit. Med. Jour., 1906, p. 1767.

and a hyperplasia of connective tissue taking the place of the degenerated material. He also described splitting of the external elastic lamina similar to that described by Jores in human vessels. The injection of diphtheria toxin seemed to affect only the first portion of the aorta and produce lesions similar to those produced by adrenalin.

The earlier experiments, in which injuries, mechanical and chemical, were applied to the vessels, do not concern us here, nor shall I consider the experiments of Lewaschew, Fränkel, and Barvoets, who produced extensive lesions in vessels by resection of nerves (sciatic nerve). Von Czyhlarz and Helbing[39] have conclusively shown that the lesions produced by these observers are of a purely inflammatory character and will not ensue if all inflammation is prevented.

Returning to the aortic lesions of the adrenalin type, there has been much discussion as to the mechanism by which these lesions are produced, more especially whether increased blood pressure—hypertension—or toxic influences are to be held responsible. If we accept the view that the lesions in question are really produced by the substances introduced into the circulation, then the theory that hypertension is the sole or even the main factor in the process seems untenable. The mere fact that similar results have been obtained by substances tending to lower blood pressure, as well as by others that have no influence whatever upon pressure, is sufficient to upset the hypertension theory. It is, besides, hardly conceivable that a sudden, even a very considerable, rise of pressure, if of short duration, could cause such extensive changes. Josué,[40] it is true, claims that repeated injections of adrenalin keep up the pressure above normal for a long time. This is denied by others. That toxic influences are at work is proved not only by the known toxic character of many of the chemicals employed, but also by the cachexia which frequently appears, and the marked toxic and irritant lesions found in other organs besides the aorta, such as the liver, the heart, the kidneys, etc., which it is not within the scope of this paper to describe. Even adrenalin, besides its pressure-raising quality, has a distinctly toxic influence on various organs and also on the blood itself, according to Loeper and Grouzon.[41]

In view, however, of the startling figures brought forward by Miles, and after deliberate and careful study of all the results, both positive and negative, at present available, it may well be questioned if the aortic lesions observed are the result of experiment, or if they are not rather simply the natural outcome of spontaneous disease without any causal relation to experimental procedures. Klotz has

[39] Experimentelle Untersuchungen über die Beziehung von Nervenlesionen zu Gefässveränderungen. Centralbl. f. Path. u. path. Anat., 1897, viii, 849.

[40] La pression artérielle chez le lapin a la suite d'injections repetées d'adrenaline dans les veines. Soc. de Biol., 1905, 319.

[41] L'action de l'adrenaline sur le sang. Arch. de med. exp, anat. et path. 1904, p. 83.

shown that long before macroscopic lesions become visible minute degenerations of the muscle cells and elastic fibers, even the beginnings of calcification, may exist. It may well be conceived that the toxic elements experimentally introduced into the circulation, if they have any effect at all, act simply as a more or less powerful stimulus upon an already diseased aorta and render active and manifest the pathological condition until then merely latent. A series of experiments by Dr. Hensel and myself, not yet published, on about 100 rabbits, with various toxic substances, taking into account the numerous negative as compared to the positive results, has suggested this conclusion to us even before the publication of Dr. Miles' paper. Fischer seems to entertain similar opinions. In the present state of our knowledge it is perhaps the most plausible solution of the difficulty, but before the question can be finally decided much more investigation will be necessary.

Do these pathological processes as found in the rabbit's aorta bear any relation to human arteriosclerosis? The majority of German authors hold the opinion that they have nothing whatever to do with human arteriosclerosis; others, especially those of the French school, unhesitatingly consider them as identical with human atheroma. Though, of course, it is far beyond the limits of this paper to enter into any details concerning the various theories of arteriosclerosis, or to discuss, no matter how briefly, the innumerable problems—physiological, pathological, histological, and clinical—offered by the vascular system,[42] it will nevertheless be necessary to state in as few words as possible what we conceive to be the present status of our knowledge of human arteriosclerosis, or "atherosclerosis," as it is aptly named by Marchand.[43] There has been a marked tendency, especially since the work of Jores[44] and his followers, to consider, when speaking of arteriosclerosis, mainly the characteristic lesions in the aorta, and to relegate to an entirely different class the calcifications and other changes in the media in other arteries, especially in the peripheral vessels, as described by Mönckeberg. This view is perhaps, as Klotz remarks, too narrow in its limitations. The clinical manifestations of arteriosclerosis are not as yet as sharply defined in all their details as may be desirable, but there is a vivid and distinct conception of human arteriosclerosis in the mind of every physician, and though perhaps somewhat loosely handled at times, is nevertheless a clinical entity dealing with the vascular system as a whole, and not merely with the aorta.

It may then be said very concisely, with Aschoff,[45] that the essential

[42] A full discussion of the pathology of arteriosclerosis and its more recent literature is given by Thorel, Lubarsch, and Ostertag, Ergebnisse, 1903, 1; 1907, ii.

[43] Ueber Arteriosklerose. Kongress f. innere Medizin, xxi.

[44] Wessen und Entwickelung der Arteriosklerose, 1903.

[45] Ueber Atherosklerose und andere Sklerosen des Gefäss-systems. Beihefte z. med. Klinik, 1908, iv, Nr. I.

and cardinal point in the pathology of atheroscleorsis is impairment and subsequent degeneration of the elastic elements. Atherosclerosis is mainly a hyperplastic and degenerative, and in no wise an inflammatory process. Endarteritis proliferans annd obliterans, though often, no doubt, associated with true atherosclerosis, must be classed separately. The same holds good for certain specific infections, especially syphilis. The latter may perhaps be a factor in bringing about general arteriosclerosis, but the easily recognized and characteristic luetic lesions as they appear in the aorta and the cerebral vessels must be separated from typical arteriosclerosis.

It is being more and more clearly recognized that different vessels have different functions, and, therefore, also different structure, and perform their work under different physical and mechanical, and possibly different chemical conditions. The aorta, for instance, especially the ascending portion, receives every moment a large volume of blood direct from the heart under high pressure and with undoubtedly numerous cross-currents and vortices, for which it must provide an even distribution. The femoral, on the other hand, at great distance from the heart, must pass the blood to the smaller arteries with sufficient force and impetus to secure uniform tension down to the capillaries. Aschoff[46] divides all arteries into two groups according to their differences in structure: those of the elastic type, aorta, carotids, and iliacs, and those of the muscular type, the majority of the peripheral arteries. In vessels of the elastic type, whose most important function it is to withstand pressure and prevent overdistention, the intima with its elastic and connective tissue elements is the more important factor; while in vessels of the second group, that have special propelling functions, the muscular elements of the media are more highly developed. It is conceivable that physical strain, toxic influences, and the like may cause different reactions in different vessels according to their type of structure and of function.

Ever since Thoma's investigations the growth and development of the bloodvessels has been the object of considerable careful research. It is generally accepted now that there is a continuous increase in length as well as a regular and progressive development of the structural elements of the aorta and larger vessels, especially of the connective and elastic tissue of the intima. With the increased demands on the vessel, reinforcements of the elastic and fibrous and also of the muscular elements keep equal step, so that under the influence of normal conditions of pressure and longitudinal and lateral tension, what may be called a physiological hyperplasia of the intima takes place. This physiological process of growth reaches its climax usually in the third decade of life. The very

[46] Generally speaking, arteries may be conceived as consisting of two concentric tubes: an inner fibro-elastic tube and an outer muscular tube.

valuable and exact measurements of Scheel[47] corroborate the results obtained by others (Bennecke and Suter). According to these investigators the completion of normal growth is followed almost immediately by the first signs of regression. Thayer and Fabyan[48] have come to similar conclusions from histological studies of the radial artery. Slowly but surely the elasticity of the arteries begins to decrease, the vessels to dilate somewhat; in other words, the first faint senile changes appear very soon after maturity is reached, and lead, in some individuals sooner, in others later, inevitably to arteriosclerosis.

There is almost a consensus of opinion that pressure and tension are the main factors in the development both of the physiological and the pathological alterations in the arteries, and that, as Albrecht[49] puts it, mechanical impairment is the underlying and primary cause of arteriosclerosis. That hard physical labor and strain tend to accelerate the normal "physiological" advent of arteriosclerosis seems more than likely. Thayer and Brush,[50] in an analysis of the records of nearly 4000 cases, find that heavy physical labor gives a very high percentage of palpable radial arteries. Baumler[51] records the interesting observation that left-handed persons often develop arteriosclerosis of the left radial, the right being normal. But arteriosclerosis is not merely the result of overstrain, of wear and tear of the arteries; is not merely an "Abnutzungs-Krankheit," as the Germans call it. There must be, beyond doubt, other and probably numerous factors tending to impair the elasticity and lower the power of resistance of the vascular walls. We cannot close our eyes to the fact that we find every now and then some fortunate ones who live to a high old age, often under great stress and strain, without showing until almost the very end of life any very marked symptoms of arteriosclerosis. On the other hand, arteriosclerosis is found with increasing frequency, as more attention is paid to the subject, in youthful individuals. Without attaching too much importance to the well-known case of Bryant and White,[52] in which all the arteries of the body with the exception of those of the head were sclerotic and calcified, or the case of Durante,[53] in which atheroma of the pulmonary artery was found, evidently prenatal, in a seven months child that died of umbilical infection shortly after birth, there are the figures of

[47] Gefässmessungen und Arteriosklerose. Virchow's Arch., 1908, cxci, Heft i, Nr. 1.

[48] Studies in Arteriosclerosis, with Special Reference to the Radial Artery. Trans. Assoc. Amer. Physicians, 1907, xxii, 694.

[49] Uber Arteriosklerose. Münch. med. Woch., 1906, 332.

[50] The Relation of Acute Infections to Arteriosclerosis. Jour. Amer. Med. Assoc., 1904, p. 726.

[51] Ist die Arteriosklerose eine Allgemein Krankheit. Berl. klin. Woch., 1905, Nr. 44a.

[52] A Case of Calcification of the Arteries, etc., in a Child aged Six Months. Guy's Hospital Reports, lv, 18.

[53] Bulletin de la Soc. Anat. 1899, p. 97.

v. Simnitzky,[54] who has confined his attention only to the aorta, but finds the early stages of arteriosclerosis in individuals under twenty-five years of age in at least 27.5 per cent. of all cases examined.

Huchard[55] and his school make the acute infectious diseases of infancy and childhood largely responsible for the arteriosclerosis of later years. Hofbauer[56] saw arteriosclerosis following measles in a boy aged seventeen years. The studies of Thayer[57] and of Thayer and Brush[58] tend to show that, besides hard work, typhoid fever and alcoholism have a marked effect upon the early development of arteriosclerotic symptoms. Richard Wiesner[59] frequently found extensive calcification in the coronaries of youthful individuals between the ages of fifteen and twenty-three years after endocarditis or prolonged osteomyelitis. Wiesel[60] made extensive studies of the heart and bloodvessels of youthful persons in many of the infectious diseases—typhoid fever, scarlet fever, measles, diphtheria, sepsis, pneumonia, osteomyelitis, etc. He found lesions in the arteries mainly in the media and in many respects resembling experimental lesions in rabbits. According to Lortat and Sabareanu[61] diseases of the thyroid gland and thyroidectomy have a decided effect upon the early and extensive development of arteriosclerosis. That alcoholism, lead, tobacco, and other intoxications tend toward the development of arterial lesions is highly probable, though not as yet positively proved. Gout and diabetes may also be mentioned as causing a marked disposition toward arteriosclerosis. According to Romberg,[62] purely psychic and emotional factors, by causing frequent, rapid, and very violent oscillations of pressure, tend in the same direction. Rumpf,[63] M. Fränkel,[64] Burwinkel[65] and Gazert[66] collect evidence to show that metabolic and chemical disturbances, both local and systemic, are often concerned in the process. Chronic nephritis has long been recognized as a cause of arteriosclerosis. Lastly, clinical observation points to hereditary disposition as an important etiological element.

[54] Ueber die Häufigkeit von Arteriosklerotischen Veränderungen in der Aorta jugendlicher Individuen. Ztschr. f. Heilkund., 1903, xxiv, 177.

[55] Les causes de l'arterio-sclerose et des cardiopathies arterielles. Rev. gén. de clinique et de thérapeutique, 1891.

[56] Wien. klin. Woch., 1903, Nr. 34.

[57] The Effects of Typhoid Fever on the Heart and Vessels. Amer. Jour. Med. Sciences, March, 1904.

[58] Relations of Acute Infections to Arteriosclerosis. Jour. Amer. Med. Assoc., 1904, p. 26.

[59] Ueber Veränderungen der Koronargefässe bei Infektionskrankheiten. Wien. klin. Woch., 1906, p. 725.

[60] Ueber Gefässveranderungen im Verlaufe akuter Infektionskrankheiten. Wein. med. Woch., 1906, p. 15; Ueber Veränderungen am Zirkulationsapparate, speziell des peripheren Gefäss-systemes bei Typhus abdominalis. Ztschr. f. Heilk., 1905, p. 107.

[61] Pathogénie de l'athérome artériel et thyroidectomie. Soc. de Biol. lvii, 444.

[62] Ueber Arteriosklerose. Kongress f. innere Medizin, 1904.

[63] Ueber Arteriosklerose. Münch. med. Woch., 1905, p. 46.

[64] Ueber Theorie und Behandlung der Arteriosklerose. Wien. klin. Rundschau, 1905, p 30.

[65] Aetiologie und allgemeine Therapie der Arteriosklerose. Berl. klin. Woch., 1905, p. 16.

[66] Ueber den Fett- und Kalkgehalt der Arterienwand bei Atheromatose und Arteriosklerose. Deut. Arch. f. klin. Med., 1899, lxii, 390.

SUMMARY. Arteriosclerosis, or, to use the better term, "atherosclerosis," may be designated as a morbid condition of the blood-vessels closely following and allied to the physiological process of development, growth, and senescence of the vascular system, and governed by the same laws. It may without exaggeration be said that atherosclerosis, viewed as a disease, is merely the anticipation in time, extent, and intensity of the normal "physiological" condition of senility. In physiological terms it may be expressed as an impairment or loss of elasticity and of functional adaptability of the vessel walls. Pathologically it is a process of degeneration of the elastic and muscular elements of the vessel walls, associated with compensatory and reparative hyperplasias and hypertrophies principally of the connective tissue elements, and often tending to calcifications and ulcerative processes. The etiological factors that determine its earlier or later onset, its localization, whether more general or more restricted to certain limited portions of the vascular system, and very probably also, at least in part, its histological structure, are manifold. Heredity and physical overstrain ("Abnutzung") in its numerous variations must certainly play an important part. It is most probable that bacterial and other infections, and intoxications with organic as well as inorganic poisons are important etiological factors, and may possibly have considerable influence on the localization as well as on the histological type of the arteriosclerotic process. We are disposed to conceive atherosclerosis, therefore, as a clinical entity. The various types of vascular degeneration briefly mentioned above—the typical lesions in the aorta, the degeneration and calicification in the media of the pulmonary artery, and especially of the peripheral vessels—with all their sequels, are all gathered together into this one large group. They all have a common etiology and are closely allied in their physiological and pathological relations. From this point of view the recent experimental researches with adrenalin, nicotine, and all the other substances would seem to have a direct bearing upon the problem of arteriosclerosis, inasmuch as they appear to demonstrate the effect of toxins of various kinds upon the development of atherosclerotic lesions in the rabbit. They would also appear to go far toward establishing a most important fact, namely, that different kinds of toxic agents can produce lesions of different histological character (bacterial toxins on the one hand and the adrenalin group of poisons on the other). It must be confessed, however, that the element of uncertainty as to how much is due to experiment and how much is spontaneous and independent of all experimentation, which clings to all of these investigations, very seriously impairs the value of all of this work and compels for the present, and until further investigation has cleared up these questions, a suspension of judgment, or at least a very guarded and

provisional acceptance of these results. It may confidently be expected, however, that further research along similar lines, with a study of spontaneous atherosclerosis, especially in carnivorous animals, both wild and domesticated, and its comparison with the human, together with the experimental investigation of the effect of bacterial infection and of toxins on other animals besides rabbits, will materially assist in advancing our knowledge and throwing some light into much that is still very obscure.

THE BACTERIOLOGY OF THE PUERPERAL UTERUS.

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The germ content of the uterus has been controversial ground for years. The question has been investigated by many since the time of Doederlein with the most varied results, to be explained, in our opinion, upon the ground of errors in technique. Probably the earliest investigator in this field was Myerhofer, who, in 1865, employed suction by means of a glass tube. He was always able to demonstrate cocci and bacilli if the case were febrile, but he did not find them in afebrile cases. Doederlein, in 1887, reported a series of 30 cases with normal temperature. In 27 of these the lochia was sterile, while in 3 bacilli were present, streptococci being identified once. He drew the conclusions from his study: (1) That in normal cases the uterine lochia is sterile; (2) that microörganisms are almost always present in severe cases of puerperal infection; (3) that infection is not always due to lack of care on the part of the physician. Von Ott and Czerniewski, in 1888, arrived at the same conclusions, but the latter held that the streptococcus might be present in the lochia of normal cases in rare instances without symptoms.

In contradistinction to the above, we wish to call attention to the statistics contributed by Stolz, who found streptococci in the vaginal secretion of three normal pregnant women, while in a series of women with abnormal vaginal secretion during pregnancy streptococci were present in several instances. In studying the puerperal uterus, he found that on the ninth day, in a series of 156

cases examined during labor, with aseptic precautions, there were 55 positive and 101 negative results, streptococci being found in 11 per cent. of the positive cases.

Neither the duration of the labor, the presence of laceration, the number of examinations during labor, or the operations performed to effect delivery seemed to alter the result. Retention of secundines did, however, increase the bacterial content. In 54 women who had not been examined in labor, and in whom the puerperium was normal, he found that in 10, cultures gave streptococci on the ninth day. In a series of over a dozen women in whom cultures were taken on the third, fourth, fifth, sixth, seventh, and eighth day, in order to determine the time of ascendancy of the germs, it was found that early in the puerperium there might be non-pathogenic organisms in the lochia with absence of any signs of infection; that the puerperium from the third day on did not differ in germ content from the later period (ninth day); that the content on the ninth day was less on the average than earlier. Therefore, he believes that in the latter days of the puerperium the uterus cleanses itself from organisms in a large proportion of cases. As his cases were not selected, there occurred a series of 18 in which, one or more days after the culture, there was a development of fever. In this febrile series, with the exception of 5 cases, there had been found a growth in culture before the appearance of the fever, and in half of the positive findings streptococci were demonstrated. In cases in which, on the earliest culture, streptococci were present, there cannot be a question of having caused the fever by infection at the time of culture, according to the opinion of the author. Doederlein and Franz also conclude that in cases of streptococcic vaginal lochia the taking of a culture is not a harmless experiment, but that the infection is sometimes to be laid at the door of the culture. Doederlein declared that the initial period of freedom from symptoms before the taking of the culture could be explained by the incubation of the organisms, but Stolz denies this. However, he does not deny that the presence of streptococci in the cavum uteri may be the cause of the development of fever, without other reason than the trauma necessitated by the culture. He makes the point that the danger is much less if the culture be taken late in the puerperium, and states that he has never seen any difficulty if he has not cultured in the early days. In studying the examination of the lochia and vaginal secretions on the fourth day, he used a series of 75 cases for the uterine lochia and 65 cases for the vaginal secretion. He found that the uterine lochia was positive in 80 per cent. and that in 36.9 per cent. streptococci were present, while the vaginal secretion in 27 per cent. gave streptococci. Both these series were entirely normal cases. He concludes as follows in regard to the findings of the fourth day: (1) That the vagina always contains organisms,

and the uterus does so in a large proportion of cases; (2) that the presence of streptococci in either situation is possible without symptoms; (3) that the uterus contains fewer germs in unexamined cases than in those examined, but streptococci are to be found in both uterus and vagina in some unexamined cases; (4) that examination with sterile hands during labor has no apparent influence upon the germ content; (5) that aseptic glove operations have no distinct influence; (6) that no actual increase in germ content appears to be dependent upon the duration of labor, but that streptococci are relatively increased.

Finally, we would quote rather extensively from the paper of Little, which appeared while this paper was in preparation. Little came to the following conclusions: (1) Cultures taken immediately after labor are sterile in 92 per cent., or in 96 per cent. if gonorrheal cases be included; bacteria may be present exceptionally, even in the absence of vaginal examinations during labor, and the puerperium may be normal; the bactericidal power of the blood serum may be the cause of a certain number of negative results. (In 10 of his 50 cases it was necessary to introduce the hand into the uterus, and it is impossible to believe that no organisms were carried into the cavity. Of course, the downward flow after labor may also be a reason for negative findings in these cases.) Upon the third day he found sterility present in 62.5 per cent. of 40 afebrile cases, as compared with 40 per cent. sterility in 10 cases in which the temperature reached 100.6° or higher. (2) That the inclusion of cases in which gonococci were demonstrated will increase these averages to 85 per cent. and 50 per cent., respectively. (The author calls attention to the fact that he has included in his febrile series cases in which the temperature rise was obviously not due to any intrauterine cause, and the lochia, being sterile in these cases, or at least in some of them, a decrease in the percentage of the negative results is caused in the afebrile series and of the positive results in the febrile.) (3) That the finding of bacteria in the cervical canal at the completion of labor does not necessarily imply their presence later in the puerperium. (In one instance, in which there was a flaw in the tube, the author found a positive result in the first culture, but a negative one the third day, and admits that this was due to contamination with cervical secretion.)

Conclusions based on the cultures made on the seventh day postpartum were as follows: (1) Absolute sterility in 50 per cent. of the afebrile cases, as compared with 20 per cent. of the febrile. (2) Inclusion of gonococci makes these averages 80 per cent. and 50 per cent., respectively. (3) Bacterial findings differ more markedly according as the case is febrile or afebrile than by clinical characteristics. (In 5 of this last series positive results were obtained in cases which had been sterile at both previous cultures.

From 3 of these 5 cases a diplococcus was obtained which resembled, and was probably identical with, the diplococcoid forms so frequently observed in the cervix and vagina, and the author thinks it may have been due to contamination, since he admits that it is impossible to get an absolutely trustworthy result by his method at this stage. In the 2 remaining cases the organisms were gonococci.) It is to be noted that in 20 cases showing bacteria on the seventh day of the puerperium the gonococcus was the organism in 12, and, further, that only 2 of the 10 febrile cases had sterile lochia on the seventh day; the streptococcus found in one instance on the third day had disappeared on the seventh day. (4) The uterus has the power of self-cleansing, and so the presence of organisms on any day of the puerperium does not mean their continued presence, and the author believes that the results given by Stolz, who found fewer organisms late in the puerperium that an at earlier period, are to be thus explained.

The gonococcal findings in his complete series of cases were demonstrated in 2.5 per cent., 25 per cent., and 30 per cent., respectively, on the first, third, and seventh days. His general conclusions as regards the effect of interference during labor are as follows: (1) Laceration of the cervix and the perineum have no bearing upon the germ content of the lochia; and (2) vaginal examinations have but slight effect (4 out of his 6 afebrile cases not examined during labor showed bacteria in the lochia, Bacillus coli communis being found once and the gonococcus three times; while 1 afebrile case was examined six times in labor and no organisms were ever found in the lochia.)

Operations to effect delivery resulted in this series as follows: In his febrile series there was one woman who had been delivered by forced accouchement who showed gonococci in the lochia; while a second one, upon whom version had been performed, was the case of streptococcic infection. There were 8 others operated upon in the series, and of them, 3 were positive (version, low forceps, and induced labor, of each, 1 case); 3 other cases showed gonococci (2 low forceps and 1 bag induction); of 2 cases, 1 gave on the third day a variety of Bacillus dysenteriæ, while the other gave Micrococcus aureus and Bacillus pseudodiphtheriæ on the seventh day (the first was a midforceps operation, and the latter a case of version). The former of these last 2 is considered to have been a contamination at the time of culture.

General Conclusions.—In 50 cases studied by Little the uterus was found to be sterile in 92 per cent., 50 per cent., and 44 per cent. on all three days. If gonococci be included, the above averages are 96 per cent., 72 per cent., and 67 per cent. The puerperium is to be noted as normal in 40 and febrile in 10 cases of this series. In the normal cases there was absolute sterility in 92.5 per

cent., 62.5 per cent., and 50 per cent., as compared with the febrile series, in which 90 per cent., 40 per cent., and 20 per cent. were found to be sterile. Including the gonococcic cases, these latter figures would be 95 per cent., 85 per cent., and 70 per cent., and 100 per cent., 50 per cent., and 50 per cent. The author considered his results as positive if bacteria were found only in smear preparations or only in cultures, as well as when present in both. It is likely, therefore, that a certain number of positive results were due to contamination and that the uterus is really sterile in a larger number of cases than these percentages would indicate. Streptococcus was present but once—a febrile case, on the third day; absent, however, on the first and seventh days. Finally, for purposes of completeness, the following schedule of results is worth including, this being taken from Little's article:

					Per cent.
Von Ott	in	9	cases	found lochia sterile in	100
Czerniewski	"	57	"	" "	98
Doederlein	"	30	"	" "	90
Doederlein	"	250	"	" "	83
Vogel	"	15	"	" "	80
Franque	"	10	"	" "	80
Kronig	"	63	"	" "	79
Thomen	"	9	"	" "	66
Walthard	"	20	"	" "	65
Stahler	"	55	"	" "	64
Franz	"	10	"	" "	0
Burckhardt	"	14	"	" "	7
Stahler	"	19	"	" "	16
Wormser	"	100	"	" "	16
Stolz on the fourth day				" "	19.6
Vogel	in	15	"	" "	34
Schauenstein	"	100	"	" "	36
Stolz on the ninth day				" "	65

The importance of definite and certain knowledge on this whole question cannot be overestimated, because of its bearing upon the general question of puerperal septic infection and more particularly upon the frequency of auto-infection. If some investigators are correct in their findings of pathogenic organisms in a great proportion of normal cases after delivery, it is very evident that the value of this method as an aid to diagnosis is nothing; and, moreover, that auto-infection is one of the most common causes of puerperal sepsis, instead of being, as is the general opinion at present, one of the most rare happenings. Even if the extreme position of Stolz with regard to the frequency of positive findings be found untenable, proof that the ascent of organisms after the first few days into the cavity of the uterus is a usual or even a moderately frequent event will render useless any further consideration of this matter, since the import of positive findings in any given case will be beyond determination.

The probability that streptococci would be satisfied to act as saprophytes within the uterine cavity after delivery being to us a

matter of grave doubt, together with the fact that in normal cases, used for demonstration of the method before the class, the laboratory reported pure streptococcic cultures, turned our attention forcibly to the question of the technique employed in the clinic for the collection of the lochia. It being a matter of common knowledge that the lower vagina in most cases is the seat of bacterial activity, and that in a goodly number the same condition prevails in the cervix and upper portion of the vagina, we felt that the method employed, while as careful as any then known to us, demanded modification if it was to be worth doing at all. At this time the ordinary Doederlein tube was employed, sterilized by boiling, and its introduction was performed with the usual aseptic precautions. Realizing that introduction without contamination from the cervix was certainly impossible, if done several days after delivery, and that it was improbable at any time, it was assumed that a positive culture obtained in a normal case simply meant that there was bacterial growth somewhere below the internal os uteri; while those in which this method gave negative results simply gave evidence of both a sterile endometrium and an absence of contamination in the vagina and cervix. Our attention, therefore, was directed toward a modification of the technique which would render possible the collection of uterine lochia without the risk of contamination from the lower canal.

After some experimentation it was decided that there had been several weak points in the technique which we had been in the habit of using, and the method upon which the present findings are based was evolved. Its most important element (see figure) is the use of a slightly curved cervical speculum, the distal end being closed by a hinged cap. A handle of convenient length is attached to render its introduction more easy. We do not claim originality for this idea, as, although at the time the fact was unknown to us, various forms of protective specula have been employed by others. We believe that our instrument will be found to be the simplest as well as the most trustworthy. To enable us to use the speculum, we discarded the typical Doederlein tube and adopted one with a uniform curve and of small caliber, easily obtained from any manufacturer.

The method in detail is as follows: The patient is placed in the lithotomy position and the external genitalia are carefully cleansed with tincture of green soap, water, and mercuric bichloride. A Sim's speculum is inserted, the cervix is grasped by a double tenaculum, and its vaginal portion cleansed with cotton and bichloride solution. The metal tube, with cap closed, is then inserted into the uterine cavity. This tube is sterilized by pressure and wrapped in two coverings, in order that the operator may remove it from the inner one without contaminating his hands. The glass tube is placed within the metal one before sterilization and is not removed

from the latter until the culture has been completed. The cap is opened by pushing the glass tube into the cavity of the uterus, a piece of sterile rubber tubing is attached to the proximal end of the glass tube, and as much lochia as possible is sucked into the glass tube by means of a hard rubber syringe. The glass tube is then withdrawn until its distal extremity is engaged within the metal tube and then both are simultaneously removed from the patient. The ends of the glass tube are sealed with wax and the tube is sent to the laboratory. The points of paramount importance, in our opinion, are the presence of the cap upon the distal end of the sheath tube and the sterilization of the tubes by pressure instead of by boiling. We also feel that the simultaneous introduction of both tubes is very important and that their simultaneous removal is but little less important.

Curved cervical speculum for taking intra-uterine cultures: *a*, tube with cap closed ready for insertion; *b*, after insertion, showing the open cap and the projected inner tube for collecting the secretions.

As important as the collection of the uterine lochia is the technique employed in the laboratory. The danger of outside contamination, especially from the tube itself, must be recognized. For this reason the tube was washed with a bichloride solution, the ends broken off, and the contents placed in a sterile Petri-dish, cultures being made from this upon the following media: (1) Agar-agar stroke plates; (2) glycerin agar stroke plates; (3) serum agar stroke plates; (4) bouillon tubes; (5) litmus milk tubes for anaërobic cultures by Wright's method; (6) glucose agar for anaërobic cultures. In addition, cover slip preparations were made, two being stained with Löffler's stain and two with Gram's stain.

At times this routine method was deviated from because of the

lack of serum agar. This medium was used for the demonstration of the gonococcus. It has been our experience in studying the gonococcus that in the secretions in which the organism could not be demonstrated microscoically no growths occurred upon the special medium used for its cultivation, and that often it could be found in the stained specimen without growth upon the artificial medium, owing to the overgrowth of a mixed culture. For this reason we do not believe that our results as to the presence of the gonococcus are vitiated by the occasional omission of this form of medium. In this series the presence of the gonococcus was remarkably infrequent. We believe this to be due to the technique, which eliminated cervical contamination and proved conclusively to our minds an already formed opinion that gonorrheal endometritis is a much rarer condition than is generally thought. We do believe, however, that this organism is present and persists for a long time in the cervix, often acting as the forerunner of septic infection. Two of the cases in this series showed the presence of the gonococcus; the streptococcus was also found. The frequency with which the gonococcus has been found by other observers we believe to be due to cervical contamination.

In determining the qualifications of a normal case, we have differed from some of the other investigators in this field. We have taken no note of lacerations of either the cervix or the perineum, the duration of the labor, the number of vaginal examinations, the parity of the woman, or the presence of evanescent temperature, unless the latter has been shown clearly to be dependent upon pathological conditions in the generative tract. In other words, we have classified a case as normal if there has been no instrumental interference in labor, if the hand has not been introduced into the uterus, if gauze has not been introduced into the uterus or vagina, and if no douches have been given, if there has been no retention of considerable portions of the placenta or membranes, and if no alteration of the odor or appearance of the lochia has occurred. In short, we use the term normal as descriptive of the most common parturient state. We believe that by so doing we are likely to reach more valuable conclusions than by more closely restricting ourselves in our selection of cases for study, since the important fact for determination is the bacterial content of the uterus in the type of case most usually met with in actual practice.

With regard to the value of the intra-uterine culture as an aid to diagnosis, we feel that it is a method which should not be neglected in the routine study of infected cases, at least in institutions having the advantage of well equipped laboratories of bacteriology. The technique as regards asepsis is more exacting than that required for successful blood culture, since the vagina and cervix, with their bacterial flora, must be traversed in obtaining the intra-uterine culture. If a suitable technique be followed, we are confident that

the results, as a whole, will well repay the time spent in the procedure; but we do not desire to be understood as affirming our belief that the method is, as it was formerly thought, a sovereign means of diagnosticating the presence or absence of infection in all cases. We have, for instance, four records not included in this paper, in which in cases afterward proved to be septic, the intra-uterine findings were negative. That such an occurrence will take place as a matter of course, more or less often in a series of examinations of septic cases, must be evident to anyone who will consider the varied manifestations of septic processes during the puerperium. On the other hand, the relative rarity of this negative finding in the presence of septic infection offers valuable evidence as to the general utility of the method.

Taken in connection with the studies upon the bacteriology of the blood which have been made in our clinic, we feel justified in making the following statements: (1) If both blood and intra-uterine cultures are negative, the temperature is due to some intercurrent condition; (2) if the intra-uterine culture is positive, but the blood culture is negative, we consider the infection to be still local in its manifestations; and (3) if the intra-uterine culture is negative but the blood culture is positive—a very unusual condition—we are justified by our general conclusions in considering that the case is one of general infection, the local endometrial condition having been either sterile from the first or having become so gradually after the general infection developed.

It will be noted that we have classified 6 cases as normal which have given cultures in the lochia, and that we have explained the growth in them by errors in technique. We feel that this demands a fuller explanation in order that we may be entirely intelligible. It is necessary that it be clearly understood in the first place that these 6 cases do not include by any means all the cases in which there was a departure from the method described in the first part of this paper. In each instance any such departure was noted at the time the culture was made, and these are the only cases associated with technical error in which a growth was obtained. In the greater number of cases, however, in which accidental departures from the technique occurred, without cultural results, the variation was trivial, being simply noted for reasons of scientific accuracy. In the 6 cases mentioned the variations in the method were of a nature to give expectation of the probability of vaginal or cervical contamination. It is also quite true that the same, or as grave, errors were made in a few cases which did not show positive results in the culture; and this emphasizes our claim that, while a technique as rigid as ours may not aways be necessary to obtain satisfactory results in each individual case, still, if error has been made in technique, it is manifestly unfair to consider positive findings as evidence of intra-uterine infection.

NORMAL CASES—CULTURES TAKEN IN THE FIRST, SECOND, AND THIRD PERIODS.

Number.	Case number.	First period: First to third day.			Second period: Fourth to seventh day.			Third period: Eighth to thirteenth day.			Remarks.
		Aërobic.	Anaërobic.	Microscopic.	Aërobic.	Anaërobic.	Microscopic.	Aërobic.	Anaërobic.	Microscopic.	
1	1	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
2	2	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
3	5	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal except for one temperature of 102° on the sixth day (a few hours after culture) falling at once to normal.
4	7	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
5	25	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Student introduced hand into vagina to deliver placenta; otherwise a normal case. On third culture three attempts made before tube passed.
6	56	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
7	57	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
8	58	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
9	61	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
10	62	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Dead foetus delivered at home: otherwise normal.
	34	See error in technique.			Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Labor normal. Error made at first culture—whereby vaginal secretion obtained.

NORMAL CASES—CULTURES TAKEN IN THE FIRST AND SECOND PERIODS.

11	13	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal. Febrile temp. once because of congested breasts.
12	27	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal. One febrile temp.
13	28	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal.
14	41	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal.
15	42	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal.
16	43	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal.
17	65	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal.
18	6	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Normal.

NORMAL CASES—CULTURES TAKEN IN THE FIRST AND THIRD PERIODS.

19	9	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.
20	14	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.
21	15	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.
22	22	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.
23	59	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.
24	69	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Steri e.	Negative.	Normal.
25	70	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.
	51	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.
	20	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Normal.

NORMAL CASES—CULTURES TAKEN IN THE FIRST PERIOD ONLY.

26	19	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Normal.
27	60	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Normal. Temperature febrile second and third day.
28	29	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Normal.
29	31	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Normal.
30	44	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Normal.
31	38	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Abortion at 6 months. Breech delivered—Wiegand.
32	39	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Normal.
33	64	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Prolapse of cord (no version). Otherwise normal.
34	4	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Normal.

NORMAL CASES—CULTURES TAKEN IN THE SECOND AND THIRD PERIODS.

35	10	....	....	....	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Tuberculosis. Irregular febrile temperature.
36	16	....	....	....	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Normal.
	55	....	....	....	Sterile.	Sterile.	Negative.	See error in technique.			Normal.

NORMAL CASES—CULTURES TAKEN IN THE SECOND PERIOD ONLY.

Number.	Case number.	First period: First to third day.			Second period: Fourth to seventh day.			Third period: Eighth to thirteenth day.			Remarks.
		Aërobic.	Anaërobic.	Microscopic.	Aërobic.	Anaërobic.	Microscopic.	Aërobic.	Anaërobic.	Microscopic.	
37	47	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Normal.
38	48	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Normal.
39	49	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Normal.
40	53	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Slight phlegmasia.
41	37	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Normal. Temperature once 101.2°
42	52	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Normal.
43	66	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Normal.

NORMAL CASES—ERRORS IN TECHNIQUE WITH POSITIVE FINDINGS.

44	34	Mic. pyog. aur., Bac. xeroides, Mic. magnus.	No obligatory anaërobe.	Gram positive micrococci and bacilli.	See normal cases: Cultures taken in first, second, and third periods.			....	....	....	The first culture was taken as a demonstration. The tube became blocked and was accidentally withdrawn and vaginal secretion inspirated.
45	20	See normal cases: Cultures taken in first and third periods.			....	....	....	Mic. pyog. alb.	No obligatory anaërobe.	Gram positive micrococci.	On last culture, tube was introduced without speculum. This growth considered vaginal or cervical contamination.
46	51	See normal cases: Cultures taken in first and third periods.			....	....	....	Mic. pyog. aur.	No obligatory anaërobe.	Gram positive micrococci.	The last culture was taken by resident physician and mistake in technique was made.
47	24	Streptococcus, Bac. coli com.	No obligatory anaërobe.	Gram positive micrococci. Gram negative bacilli.	....	....	....	....	....	....	Attempt to pass tube failing, it was withdrawn and passed by the aid of vaginal touch. Case normal clinically.
48	54	....	....	....	Mic. pyog. alb.	No obligatory anaërobe.	Gram positive micrococci.	....	....	....	Tube boiled and passed without speculum.
49	55	....	....	....	....	....	....	Mic. pyog. alb. bac.	No obligatory anaërobe.	Gram positive micrococci.	Tube passed without speculum; cervix not cleansed; cap opened in vagina.

Abnormal Cases Obstetrically—Forceps.

50	45	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Low Sawyer forceps.
51	18	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	....	....	....	Simpson forceps. Slight fever on third day.
52	63	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Simpson forceps. Bad cervical tear. Much clotted blood in vagina at first examination. Vaginal discharge foul. Intra-uterine douche several times before last culture. Leukocytes, 14,000. Blood culture, negative
53	40	Sterile.	Sterile.	Negative.	....	....	....	....	....	....	Low forceps. Temperature never febrile.
54	50	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Simpson forceps. Temperature never febrile.

Abnormal Cases Obstetrically—Douches; Manual Removal of the Placenta; Version; Intra-uterine Pack

55	23	Sterile.	Sterile.	Negative.	....	....	....	Sterile.	Sterile.	Negative.	Temperature never febrile. Intra-uterine douche before cultures.
56	17	Mic. pyog. alb.	No obligatory anaërobe.	Gram positive micrococci.	....	....	....	Sterile.	Sterile.	Negative.	Adherent placenta. Manual removal. Normal temperature.
57	35	....	....	....	Sterile.	Sterile.	Negative.	Sterile.	Sterile.	Negative.	Placenta previa with version. Gauze pack. Irregular fever. Lochia foul. Complete tear. Child macerated. Blood culture negative.
58	46	....	....	....	Sterile.	Sterile.	Negative.	....	....	....	Intra-uterine pack.

Abnormal Cases Obstetrically—Craniotomy.

59	30	Mic. pyog. alb., Bact. coli com.	No obligatory anaërobe.	Gram positive micrococci. Gram negative bacilli.	Mic. pyog. alb. Bact. coli com.	No obligatory anaërobe.	Gram positive micrococci. Gram negative bacilli.	....	....	....	Never febrile. Craniotomy. Fetid discharge. Probable muscular rupture of uterine wall.
60	11	....	....	....	Mic. magnus. Mic. pyog. aur.	No obligatory anaërobe.	Gram positive micrococci.	....	....	....	Craniotomy for hydrocephalus Normal temperature.

Intercurrent Disease—Typhoid Fever

Number.	Case number.	First period: First to third day.			Second period: Fourth to seventh day.			Third period: Eighth to thirteenth day.			Remarks.
		Aërobic.	Anaërobic.	Microscopic.	Aërobic.	Anaërobic.	Microscopic.	Aërobic.	Anaërobic.	Microscopic.	
61	33	....	....	....	....	....	....	Sterile.	Sterile.	Negative.	Douche before admission. Blood culture. Bac. typhosus.

Gonorrhœal Cases.

62	12	Mic. pyog. aur.	No obligatory anaërobe.	Gram positive micrococci. Gonococci.	Mic. pyog. aur.	No obligatory anaërobe.	Gram positive micrococci. Gonococci.	....	....	....	Child developed ophthalmia neonatorum. Never febrile.
63	26	Sterile.	Sterile.	Gonococci.	....	....	....	Sterile.	Sterile.	Gonococci.	Douche before second culture. Febrile after first culture. Diagnosis: Gonorrheal rheumatism and breast abscess.
64	67	Streptococcus.	No obligatory anaërobe.	Gram positive micrococci. Gonococci.	Sterile.	Sterile.	Negative.	....	....	....	Normal temperature.

Septic Cases.

65	3	Sterile.	Sterile.	Negative.	Streptococci	No obligatory anaërobe.	Gram positive micrococci.	....	....	....	Blood culture showed streptococcus pyogenes. Febrile third to fourteenth day. Breast congested. Many intra-uterine douches.
66	63	Streptococcus.	No obligatory anaërobe.	Gram positive micrococci. Gonococci.	Streptococci	No obligatory anaërobe.	Gram positive micrococci. Gonococci.	....	....	....	Febrile 3 days. Manual extraction placenta. Purulent cervical discharge. Diagnosis puerperal endometritis.
67	21	....	....	....	....	....	....	Streptococcus.	....	Gram positive micrococci.	Blood culture: Steptococcus pyogenes.

To consider these 6 cases from the standpoint of actual the error occurring in each case:

CASE XXXIV.—The first culture showed Micrococcus aureus and magnus and Bacillus xeroides. The case was used for demonstration, the tube accidentally slipping, whereby vaginal secretion was inspirated.

CASE XX.—First culture sterile; second culture gave Micrococcus albus. Here the variation consisted in the omission of the Sim's speculum in the introduction of the tube, it being guided into the cervix by the finger in the vagina.

CASE LI.—In this case the first culture was sterile, while the second, taken by an assistant, showed a growth, Micrococcus aureus. In both instances the variation in technique was identical, the vaginal speculum being omitted. From our knowledge of the ease of contamination, we consider that this second culture was contaminated by lack of care upon the part of a man inexperienced in the method. We admit that this contention is not proved.

CASE XXIV.—But one culture was made, and this gave the streptococcus and the colon bacillus. In this instance the Sim's speculum prevented sufficient depression of the tube to enable it to pass, so the former was discarded and the tube was passed by guidance of the finger. During the short time elapsing between the introductions, the tubes were both placed in the instrument tray, which was an additional source of possible infection.

CASE LIV.—Tube was introduced by guidance of a finger in the vagina. In addition, the tube was sterilized by boiling instead of by pressure.

CASE LV.—Tube was introduced, as in the last case, and, in addition, the cap of the metal tube opened while it was in the vagina during the introduction.

It is to be noticed that the omission of the Sim's speculum was noted in each instance in which in a normal case a growth was recorded. In two instances there were other factors present which would have been sufficient to cause contamination—in one case the protective cup was open during introduction, while in the other both tubes lay for several minutes in an instrument tray the sterility of which during that period must be considered doubtful.

Because of difficulties inherent to the work it was not possible, and, indeed, it did not seem desirable, to culture each case upon the same day of the puerperium, so we have divided the cultures into three periods. We have further divided the whole list of cases under various headings, as follows:

A. Clinically normal cases:

1. Cultures during first period (first to third day), 34 in number; all sterile.
2. Cultures during second period (fourth to seventh day), 29 in number; all sterile.

3. Cultures during the third period (eighth to thirteenth day), 18 in number; all sterile.

B. Clinically normal cases with errors in technique and positive results:

1. Cultures during first period, 2 in number.
2. Cultures during second period, 1 in number.
3. Cultures during third period, 3 in number.

(All of these cases, with one exception, in which but one culture was taken, showed negative results from other cultures made without error.)

C. Clinically abnormal cases:

(*a*) Forceps (in excavation or at outlet), 5 cases.

1. Cultures during first period, 4 in number; all sterile.
2. Cultures during second period, 3 in number; all sterile.
3. Cultures during third period, 1 in number; all sterile.

(*b*) Douches (intra-uterine), 1 case:

1. Cultures during first period, 1 in number; sterile.
2. Cultures during third period, 1 in number; sterile.

(*c*) Manual removal of placenta, 1 case.

1. Cultures during first period, 1 in number; growth.
2. Cultures during third period, 1 in number; sterile.

(*d*) Craniotomy, 2 cases:

1. Cultures during first period, 1 in number; growth.
2. Cultures during second period, 2 in number; growth.

(*e*) Version for placenta prævia (macerated fœtus):

1. Cultures during second period, 1 in number; sterile.
2. Cultures during third period, 1 in number; sterile.

(*f*) Uterine packing:

1. Cultures during second period, 1 in number; sterile.

D. Intercurrent disease:

Typhoid fever (blood positive).

1. Cultures in third period, 1 in number; sterile.

E. Gonorrhœa:

1. Cultures during first period, 3 in number; all positive.
2. Cultures during second period, 2 in number; 1 positive.
3. Cultures during third period, 1 in number; positive.

One case, positive in the first and third periods, was unassociated with other organisms. In this case blood examinations were negative, but a mammary abscess and gonorrhœal rheumatism were complications.

The second case, positive in the first and second periods, was associated with Micrococcus aureus in both cultures; while the third case, positive at the first culture and associated with streptococci, was negative in the second period and also sterile at this time.

F. Septic cases (3):

1. Cultures during first period, 2 in number; positive.
2. Cultures during second period, 2 in number; positive.
3. Cultures during third period, 1 in number; positive.

(Cultures not taken of third case during first or second period.) Blood cultures were positive in 2 of the above cases, and were not taken in the third case.

GENERAL CONCLUSIONS.

1. The uterine lochia is sterile in normal cases throughout the puerperium.
2. Streptococci are never present within the cavum uteri without causing symptoms.
3. In a few instances non-pathogenic germs may be found in cultures in afebrile cases, but there is every reason to believe that their presence is really the result either of contamination during the extraction of the lochia or of their introduction during obstetric manipulation.
4. Ascendance of the gonococcus is an event of comparative rarity, though the frequency of this organism would of itself give reason to expect otherwise.
5. Infection of the endometrium is an ever present danger in culturing within a few days of delivery.
6. A study of the bacterial content of the puerperal uterus is of great importance as a subsidiary means of diagnosing septic infection following delivery.
7. As nearly as may be, a technique should be adopted which will prevent contamination during the removal of the lochia in order to avoid a vitiated result.

REVIEWS.

MODERN MEDICINE. ITS THEORY AND PRACTICE. In original contributions by American and foreign authors. Edited by WILLIAM OSLER, M.D., Regius Professor of Medicine in Oxford University, England. Assisted by THOMAS MCCREA, M.D., Associate Professor of Medicine and Clinical Therapeutics in Johns Hopkins University, Baltimore. In seven volumes. Volume III; pp. 960; 44 illustrations. Philadelphia and New York: Lea Brothers & Co., 1907.

VOLUME III of Osler's *Modern Medicine* is devoted to a consideration of those infections not dealt with in Volume II, as well as diseases of the respiratory tract. The most important subject discussed is tuberculosis, to which about 300 pages are devoted: E. R. Baldwin discusses the history and etiology; W. G. MacCallum, the pathology; and Lawrason Brown, the symptoms, diagnosis, prognosis, prophylaxis, and treatment. These contributions are of an unusually high order of merit; they comprise all of importance that is really known of the subject, and they reflect, on the one hand, the notable work done at Saranac under the inspiration and direction of Trudeau, and, on the other hand, the painstaking study of the pathology of disease at the Johns Hopkins University. Among the several topics of much interest dealt with by Baldwin are: the considerable reduction in the mortality rate of tuberculosis in civilized countries (from one-seventh of all deaths in 1890 to one-tenth of all deaths in 1900), a result attributable to the special attention given to the hygienic control of the disease; the different types of the tubercle bacillus—the human, the bovine, the avian, and the reptilian and piscine—and their points of similarity and means of identification; tuberculin; and the mechanism of resistance and immunity. MacCallum's article is a masterly description of the pathology of the divers lesions of tuberculosis. Of Brown's contributions, perhaps the section devoted to prophylaxis and treatment will be read with most interest by the general practitioner. Lack of space forbids detailed reference to the many important aspects of the question discussed, but the general breadth of view and wide scope of the article becomes apparent from a mere mention of certain of the subheadings, such as: State and municipal control of tuberculosis, trade regulations, general prophylaxis, individual prophy-

laxis, and the many viewpoints from which treatment as such is approached: treatment at home and in institutions, the influence of climate, of hygiene, of diet, of medicines, of certain specific remedies, as well as surgery, and divers accessories. The article is altogether admirable and replete with many practical suggestions.

Dr. Osler, with the coöperation of John W. Churchman, provides an excellent discussion of syphilis, which well exemplifies a saying attributed to the Sage of Oxford (but then of Baltimore), that he who knows syphilis knows medicine. This chapter contains some interesting and well told historical data; an account of the etiological significance of Spirochæta pallida; an excellent description of the clinical manifestations of the infection in the different organs and tissues; a discussion of measures of prophylaxis, including some sane remarks upon the moot question of the state control of prostitution; and full details of treatment. Apropos of prophylaxis, the opinion is expressed that our greatest hope of controlling the ravages of the infection lies in educating not only the masses, but also the more educated classes, and that no one can accomplish more in this particular than the general practitioner.

Other contributions also deserve mention. The opening chapter in the book is on Malta fever, by Colonel David Bruce, whose name is indissolubly associated with the discovery of the specific etiological factor. The widespread prevalence of the infection is commented upon, and the evidence in support of the likely mode of infection by goat's milk is duly presented. Maximilian Herzog writes of beriberi, and discusses the many views entertained from time to time regarding its etiology. Among other matters he comments upon the results of the researches during the Russo-Japanese war, of Okata and Kobubo, who isolated a coccus that they believe to be the specific cause. Herzog was unable to confirm these results in about 50 cases studied in the Philippines, and, while professing his belief in the infectious nature of the disease, he inclines to the opinion that the specific cause has not yet been discovered. M. P. Ravenel discusses anthrax, rabies, and glanders, and among other interesting topics, points out the nature and the lesions of rabies, with the investigation of which in this country his name is well known; James M. Anders contributes a valuable study of tetanus, emphasizing the importance of using antitetanic serum in doubtful cases before the onset of trismus; Rufus I. Cole writes of gonococcic infections, of which not the least important are the metastatic phenomena (including the recently determined gonococcic nature of many cases of painful heel or painful foot), all of which are discussed in becoming detail; Isadore Dyer treats of leprosy, of which, perhaps, it suffices to say that it meets one's expectations; and Thomas R. Boggs, in a lucid manner, discusses a number of infections of doubtful nature, such as febricula, glandular fever, infec-

tious jaundice, miliary fever, Rocky Mountain spotted fever, psittacosis, foot-and-mouth disease, and milk sickness.

Three hundred and seventy-two pages are devoted to diseases of the respiratory tract, the contributions being as follows: The mechanics of respiration and of the respiratory tract, by Thomas R. Brown; diseases of the nasopharynx, pharynx, and tonsils, by Francis R. Packard; hay fever, by W. P. Dunbar; diseases of the larynx, by H. S. Birkett; diseases of the bronchi, by A. P. McPhedran; diseases of the lungs, by Hobart A. Hare; diseases of the pleura, by Frederick T. Lord; pneumothorax, by Walter B. James; and diseases of the mediastinum, by Henry A. Christian. In a series of articles of such uniform excellence, it is doubtless invidious to seek out any for special commendation; perhaps, however, without disparaging what remains, one may point to the excellence of Brown's contribution; of Dunbar's discussion of hay fever, in which he mentions his views regarding the etiology, as well as the results of his serum therapy; of McPhedran's description of bronchitis (following Marfan's classification); of Hare's treatment of bronchopneumonia; of Lord's discussion of pleuritis and its treatment; and of Christian's description of the intricate disorders of the metiastinum. James' article on pneumothorax, of a high order of merit, is much enhanced in value by several excellent colored illustrations. Packard's and Birkett's contributions are valuable articles by specialists for the general practitioner.

As a whole, the volume contains an unusual wealth of valuable information well presented; in general excellence, it is a worthy brother (or sister) of those that have gone before, and it augurs well for those that are to come. A. K.

SURGERY, ITS PRINCIPLES AND PRACTICE, by various authors. Edited by WILLIAM WILLIAMS KEEN, M.D., LL.D., Emeritus Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College, Philadelphia. Vol. II, pp. 920; 572 illustrations. Vol. III, pp. 1132; 562 illustrations. Philadelphia and London: W. B. Saunders Co., 1907–1908.

THE second and third volumes of Keen's *Surgery* have followed with reasonable promptness the publication of Volume I, which was reviewed in these columns little more than a year ago. Volume II includes articles on diseases of bones, by Nichols, of Boston; fractures, by Eisendrath; surgery of joints, by Lovett and Nichols; dislocations, by Eisendrath; surgery of muscles, tendons, and bursæ, by Binnie; orthopedic surgery, by Lovett; surgery of the lymphatic system, by Gerrish; surgery of the skin, by John A. Fordyce, of New York; pathology of surgical disorders of the nervous system, by W. G. Spiller, of Philadelphia; surgery of the

nerves, by George Woolsey; traumatic neurasthenia, traumatic hysteria, and traumatic insanity, by F. X. Dercum; surgery among the insane, by J. Chalmers DaCosta; and surgery of the spine, by George Woolsey.

Among such a wide range of subjects, it will be impossible to select more than a few for comment. The surgery of the osseous system is well presented in the chapters by Nichols, Eisendrath, and Lovett; yet, in the treatment of the important subjects of fractures and dislocations, we must confess to disappointment. It is certainly simple, but it is scarcely satisfying, to be told that traumatic delirium is delirium tremens in non-alcoholics. The presentation of gunshot fractures is inadequate. In rupture of the main artery of a limb, Dr. Eisendrath advises immediate amputation. Perhaps at the present day it would not have been entirely out of place at least to suggest an attempt at arteriorrhaphy.

The classification of joint diseases adopted by Nichols, in describing their pathology, is not followed by Lovett in discussing the surgery of joints. The former adheres to a pathological classification rather than an etiological, because various causes produce identical lesions, and because the same cause at different times produces different lesions. The surgery of joints is discussed under the following heads: (1) Acute and chronic synovitis; (2) infective arthritis (gonorrhœal, influenzal, typhoid, rheumatic, etc.); (3) arthritis deformans; and (4) tuberculosis. Lovett considers tuberculin unreliable for diagnosis; he gives the ultimate mortality for spine and hip tuberculosis as 30 per cent. If a cold abscess is very large, he advises that it be incised and cleansed, but neither packed nor sutured.

From the violence of the manipulations advised in the bloodless reduction of congenital dislocations of the hip, it is small wonder that Lovett states that "excessive extravasations are usual and temporary paralyses are not uncommon accompaniments of the operation." He reports 62.5 per cent. of anatomical repositions among 32 cases, secured by manipulation, at the Boston Children's Hospital. It would seem, on the other hand, that his strictures upon the dangers of instrumental force in correcting club-foot deformities argue either inexperience of these methods or unjustifiable force. The bibliography to the chapter on orthopedic surgery is very large, occupying two pages and a half, and apparently has been considerably reduced by the editors, a number of references in the text (Nos. 34 to 69, inclusive, for example) being wanting in the table of authorities cited.

The account of the surgery of the lymphatic system, by Gerrish, is admirable. He supports the view that it is a closed system. He maintains that Hodgkin's disease is an affection sui generis, neither tuberculous nor sarcomatous. There is included an exhaustive account of filariasis.

The surgery of the nervous system is admirably discussed by Spiller, Dercum, DaCosta, and Woolsey; but in the last article there is inserted an appalling list of *corrigenda*, which, alas! by no means includes all of the typographical errors. Spiller discountenances routine operation for fracture of the vertebræ; he advises against radical operation for glioma of the brain, holding decompression sufficient; he thinks gumma of the brain very unusual, stating that the lesion is much mor apt to be meningitis or arteritis. Woolsey seems inclined to accept the theory of peripheral regeneration of axones. DaCosta, in discussing craniotomy for microcephalus, says with characteristic force that "the surgeon who removes a strip of the skull in order to cause the brain to develop acts as wisely as would a man in removing a section from the dome of a cathedral in order to increase the stature of the archbishop."

Volume III opens with an article on the surgery of the head, by Harvey Cushing. There follow chapters on the surgery of the neck, by E. Wyllys Andrews, of Chicago; on diseases of the thyroid gland, by Dr. Albert Kocher; on the nose and its accessory sinuses, by Harmon Smith, of New York; the larynx, the trachea, and the thorax, by George E. Brewer, of New York; surgery of the breast, by Finney; of the mouth, teeth, and jaws, by Edmund Owen; of the tongue, by Da Costa; on the technique of abdominal surgery, the surgery of the abdominal wall, of the retroperitoneal space, and of the peritoneum, by John C. Munro, of Boston; surgery of the œsophagus, by Professor Gottstein, of Breslau; of the stomach, by Mayo Robson; of the liver, gall-bladder, and the biliary ducts, by William J. and Charles H. Mayo; and on the pancreas and spleen, by Moynihan.

The most valuable as well as the longest (260 pages) of these articles is that by Cushing, on the surgery of the head. It fully justifies for itself the claim made by the publishers for all the articles, namely, that of being a complete monograph on the subject discussed. The article is encyclopedic; we have noticed no faults of omission, and if there be any fault of commission, it is, perhaps, shown in the tendency to regard the operation described as "subtemporal decompression" as a panacea. The account of the mechanism of skull fractures is illuminating. Cushing deprecates search for the bullet in gunshot wounds; he urges the operative treatment of hemorrhages in the new born; he prefers ligation of the carotid to ligation of the orbital veins for pulsating exophthalmos; he advises postponing exploration for brain abscess until a day or two after cleaning out the mastoid, to see whether the symptoms subside; he repeatedly warns against the danger of indiscriminate lumbar puncture; and he regards as useless the time-honored practice of venesection for cerebral compression, because high blood pressure is the result, not the cause, of the condition. He thinks craniocerebral topography overestimated, because it is never

entirely accurate; he prefers to class as endotheliomas tumors commonly known as fibrosarcomas; he insists on the difficulty which sometimes exists in differentiating the cerebral symptoms of nephritis from those of brain tumor; and he states that apoplexy in the young is not infrequently due to hemorrhage into a tumor in a silent region of the brain. He never uses the dental engine, preferring hand-driven instruments.

The article on the surgery of the neck is carelessly written, and the appended bibliography is a mere jumble of titles, useless, because no references to them are to be found in the text.

Dr. Kocher writes that "the function of the parathyroids is partly, or perhaps chiefly, to take up the toxic or secretory materials of the thyroid gland and to prepare them for more rapid excretion through the kidneys." He states of surgical treatment of Graves' disease that "to say that this is still the best is not enough." But it must be acknowledged that this dictum is based on empiricism rather than on pathology, and that it is liable to be questioned so soon as the pathology of the disease shall be thoroughly understood. Prof. Kocher's 200 operations for Graves' disease gave an operative mortality of 4.5 per cent., with 85 per cent. of cures.

Apart from a rather overcolored picture which he draws of the advantages of Sauerbruch's air chamber, there is nothing particularly noteworthy in Dr. Brewer's chapter on thoracic surgery. Finney gives a good account of Paget's disease of the nipple, and insists on its malignancy; but his descriptions of tumors of the breast lack definiteness.

Owen contributes an excellent article on surgical affections of the mouth, teeth, and jaws. He cadidly says that patients with epithelioma of the mouth usually come to the surgeon in such a condition that if he considered only his own peace of mind he would decline to interfere. DaCosta, writing on the surgery of the tongue, insists on the removal of the lymph nodes, even in the "earliest" cases, stating that they are always microscopically invaded, and that if the base of the tongue is involved, both sides of the neck are infected.

Munro's articles on the abdomen, while excellent, present nothing calling for special comment. It may be thought that he aimed to condemn with faint praise Ochsner's treatment of peritonitis. He gives no satisfactory idea of the prognosis in cases of diffuse peritonitis under any form of treatment.

Robson urges gastro-enterostomy for ulcer of the stomach, even if the ulcer be excised. He advises free irrigation in "general septic peritonitis" from perforation, and also urges gastro-enterostomy after suture of the perforation if the patient can bear it. The Mayo brothers minimize the functional value of the gall-bladder; they have removed it in one out of every three patients. The article is particularly good in description of operative detail, but leaves something to be desired in regard to the pathogenesis of

these diseases. Moynihan's chapters on the pancreas and spleen are characterized by their comprehensiveness, and by the author's usual clearness of diction.

As a whole, the several chapters furnish their readers with a representative account of modern surgery, in which practice decidedly overshadows principle, but which, in a few instances, include enough of the latter to render them absolutely authoritative.

A. P. C. A.

PULMONARY TUBERCULOSIS: ITS MODERN AND SPECIALIZED TREATMENT. By ALBERT PHILIP FRANCINE, A.M., M.D. Second edition. Philadelphia and London: J. B. Lippincott Company, 1907.

ALTHOUGH much has been written on the modern treatment of pulmonary tuberculosis and the remarkable results that have been obtained, the vast majority of the medical profession have not yet acquired a sufficient knowledge of the hygienic method to carry it out successfully. There is truth in the somewhat paradoxical statement that the general practitioner should be a specialist in phthisotherapy. He is the man behind the gun in the fight against tuberculosis, as Dr. Osler has said, and if the fight is to be a winning one, the general practitioner must do effective work. The present volume forms a trustworthy guide to the hygienic-dietetic treatment of this disease. The different aspects of the subject are presented in a clear and interesting manner. A good deal of valuable information has been collected that will not be found in larger and more pretentious works. The chapters on rest, diet, and climate are excellent. The great importance of rest is emphasized, and the statement of Hilleary is endorsed that "exercise brings more tuberculous patients to grief than all other things combined." The position held in regard to the vexed question of climate is the "golden middle road" between those who deny altogether its influence and the other extremists who hold, with the committee of the National Association, that in those cases treated by change of climate the amelioration of symptoms and general improvement "far surpass the very best results obtainable in similar advanced cases in our cities on porches or roof gardens."

It is to be regretted that the diagnostic use of tuberculin is not more fully described, and also the method of preparing the proper dilution for injection. The only dosage given is that of Pickert, who begins with 0.5 mg. and whose maximum does is 2.5 mg. of old tuberculin. Koch's original procedure, with an initial dose of 0.1 or 1 mg. and a maximum of 10 mg., certainly deserves mention. It is still in general use, and is the one recommended with minor modifi-

cations by a number of the most recent writers (Bendelier, Junker, Roepke). A maximum dose of 5 mg. is advised by Turban, while Cornet, B. Fraenkel, Schlüter, Madison, and others insist on the importance of employing a final dose of 7 or 10 mg. if a negative result is obtained with smaller amounts. The statement is made on the authority of Roth-Schulz that a rise in temperature of 0.1° F. above the previous maximum is considered a positive reaction. This is an unfortunate typographical error. In the paper quoted Roth-Schulz says the increase should be at least 0.5° C. Dr. C. L. Minor's admirable "Hints and Helps" to tuberculous patients are included in the volume. J. H. P.

ETUDE HISTO-CHIMIQUE ET CYTOLOGIQUE DE CRACHATS. Par LE DR. S. ISRAELS, de cong, ancien interne lauriat des Hopitaux de Paris, Pp. 151. 4 plates. Paris: G. Steinheil, 1907.

THE monograph is confined exclusively to an elaborate micro-chemical and cytological study of the sputum, instigated by the work of Bezernçon and others upon the cytodiagnosis of body fluids. For this investigation special stains, particularly the polychrome methylene blue of Unna were used. The author by his methods differentiates true mucus both from a reticulated mucus which is derived from degenerated cells, and from a sero-albuminous exudate which in its micro-chemical reactions resembles the albuminous fluid of a pleural exudate. True fibrin was not seen in the sputum. The cytological study of the sputum in different diseases did not bring out any very new facts, though certain interesting changes in the cell-content of the sputum, during such diseases as pneumonia, could be followed. W. T. L.

MATERNITY. By HENRY D. FRY, M.D., Sc.D., Professor of Obstetrics in the Georgetown University, Washington, D. C. Pp. 220. New York and Washington: The Neale Publishing Co., 1907.

WE must admit that our first feeling is always one of hostility to books which aim at the medical instruction of the laity. We believe that the majority which have appeared had better not have been written, and that much harm has been done by such publications. With these convictions, it will readily be understood that we approached this volume with anything but pleasurable expectations, particularly as it is our pet conviction that the less a woman knows

of the possibilities of labor and pregnancy, the better it is for her peace of mind. We are glad, however, to be able to give the book our approval. Its advice is sane and in accord with what we are pleased to consider the best teachings of the day. It opens with an exceedingly interesting historical sketch of childbearing, followed by a chapter upon the hygiene of girlhood. The various subjects relative to the childbearing process are discussed, and the book ends with chapters upon the care and feeding of infants.

The author writes from a rich experience both as a teacher and practising obstetrician, an advantage which, we are compelled to say, is but rarely possessed by those preparing books for lay readers. The book can be safely placed in the hands of the pregnant woman; moreover, a mastery of its contents will tend to advance the cause of scientific care during this period, since women would be in a position to demand better oversight than is received by the large majority even at the present day. W. R. N.

Surgical Instruments in Greek and Roman Times. By John Stewart Milne, M.A., M.D. (Aberd.), Keith Gold Medalist in Clinical Surgery. Pp. 187; 54 plates. The Clarendon Press, Oxford, England, 1907.

This book, which was presented as a thesis in an examination for the degree in medicine in the University of Aberdeen, endeavors to give an account of the various instruments used by the medical profession in ancient Greece and Rome. The material used was gathered from various museums, especially those of Europe, and a patient and no doubt laborious search in the literature of a half-dozen languages. Such industry deserved the "Highest Honors" gained, and has resulted in a worthy addition to the too scanty literature in English of the work of our predecessors. The author discusses the material, execution, and ornamentation of various instruments, and describes the types of knives, probes, forceps, cauteries, etc., which were used. Among the many interesting facts contained in the volume may be mentioned the use of a varix extractor by Galen, an instrument which in recent years has been rediscovered; a lenticular or chisel guarded by a button and driven by a hammer through the skull to form an osteoplastic flap; the use of the uterine sound by Hippocrates for correcting malpositions of the uterus and for dilating the cervix, which instrument was subsequently rediscovered by Simpson.

The volume is completed by the insertion of 54 plates, reproducing from photographs a great variety of instruments stored in various museums. G. P. M.

NOTHNAGEL'S ENCYCLOPEDIA OF PRACTICAL MEDICINE. DISEASES OF THE HEART. By PROF. TH. VON JURGENSEN, of Tübingen; PROF. DR. L. KREHL, of Greifswald; and PROF. DR. L. VON SCHRÖTTER, of Vienna. Edited, with additions, by GEORGE DOCK, M.D., Professor of Medicine in the University of Michigan, Ann Arbor. Authorized translation from the German, under the editorial supervision of ALFRED STENGEL, M.D., Professor of Clinical Medicine in the University of Pennsylvania. Pp. 848; 81 illustrations. Philadelphia and London: W. B. Saunders Co., 1907.

THE volume of Nothnagel's *Encyclopedia* devoted to Diseases of the Heart is so well and favorably known even to those that have only a nodding acquaintance with German, that it suffices perhaps merely to mention the publication of an English translation. Professor von Jürgensen discusses insufficiency (weakness) of the heart, endocarditis, and valvular disease; Professor Krehl, diseases of the myocardium and of the nervous mechanism of the heart; and Professor von Schrötter, diseases of the pericardium. If there is some overlapping and some repetition—almost if not quite inseparable from collaborated books—this is, as the editor points out, "more than made up by finding in the book the sound learning and wide clinical experience of Professors von Jürgensen and von Schrötter, and the deep and broad training in anatomy, physiology, and pathology, as well as the excellent clinical observation, of Professor Krehl." While Dr. Dock has not attempted radical alterations or additions, he has materially enhanced the value of the book by incorporating important contributions, chiefly American and English, that have appeared since the volume was originally published in German. A. K.

DISEASES OF THE MALE GENERATIVE ORGANS. By EDRED M. CORNER, M.A., M.B., B.Sc., M.C., F.R.C.S., Surgeon to Out-Patients, St. Thomas' Hospital, London. Pp. 279; 41 illustrations. London: Henry Frowde, Oxford University Press; Hodder & Stoughton, 1907.

IT is with considerable surprise that one learns that so much can be written upon this subject after the author has excluded the following topics: gonorrhœa and syphilis; affections of the prostate; and all diseases of the urinary tract. Thus pared down, the topics discussed at somewhat tedious length in this volume are: hydroceles and hematoceles; physiology of the testicle; the wandering or movable testicle; the imperfectly descended testicle; the testicle, its

relation to its blood supply, its duct, and inflammation; torsion of the testicle; epididymitis, orchitis, etc.; functional affections; diseases of the spermatic cord and of the vesiculæ seminales; some diseases of the urethra; diseases of the prepuce and penis, and of the scrotum.

Much of the matter contained in this book has been published by the author from time to time in somewhat similar form, in various journals; but the subjects are greatly elaborated in their present dress, and may prove of interest to those who do much pediatric surgery. Particularly instructive are Mr. Corner's well-known studies of the wandering testicle, and its relation to hernia in childhood; also the sections dealing with tuberculosis of the testicle.

A. P. C. A.

MANUAL OF ANATOMY, SYSTEMATIC AND PRACTICAL, INCLUDING EMBRYOLOGY. By A. M. BUCHANAN, M.A., M.D., C.M., F.F.P.S. (Glas.), Professor of Anatomy in Anderson's College, Glasgow, Scotland. Vol. II; pp. 965; 363 illustrations. Chicago: W. T. Keener & Co., 1907.

VOLUME II, of Buchanan's Anatomy is devoted to the abdomen, the thorax, the head and neck, the nervous system, and the organs of special sense. It follows the general plan of Volume I, which we have already noticed. At the end of the different sections are directions for dissecting; those relating to the abdomen and the thorax are excellent. The illustrations—line cuts, in black and colors—are mostly original and good. An appendix contains the Basel anatomical nomenclature and a useful glossary. As we said of Volume I, the book is a personal work, reflecting the views of a distinguished teacher, and, doubtless, it will be well received and prized by the author's students and friends; but lacking any features that distinguish it in a noteworthy manner from other good anatomies, it probably will not appeal to a very large circle of readers. A. K.

ELEMENTS OF HUMAN PHYSIOLOGY. By ERNEST H. STARLING, M.D. (Lond.), F.R.C.P., F.R.S., Jodrell Professor of Physiology, University College, London. Eighth edition; pp. 716; 323 illustrations. Chicago: W. T. Keener & Co., 1907.

THAT a book reach the eighth edition it must be meritorious; that Professor Starling's *Elements of Human Physiology* is meritorious is known to all who take any interest in the subject. Professor Starling has aimed to give in the shortest possible compass the essentials of physiology that should be familiar to every student and practitioner, and he has succeeded well. The book, undoubtedly, will secure an ever increasing circle of readers. A. K.

PROGRESS

OF

MEDICAL SCIENCE.

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UNDER THE CHARGE OF

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The Passage of Pancreatic and Intestinal Juices and of Bile into the Stomach.—BOLDYREFF (*Zentralbl. f. d. med. Wissensch.*, 1908, xlvi, 194; *Pflüger's Archiv*, cxxi, 13) has made a complete review of the literature concerning this question before giving the results of his own observations. His work was done upon dogs in which a gastric fistula had been produced. Boldyreff found that there was a passage of pancreatic and intestinal juices and of bile into the stomach, and that this occurred under definite conditions, the result, apparently, of physiological demands. This passage occurs not occasionally as a result of antiperistalsis, but constantly when the proper conditions exist. The physiological causes of the entrance of duodenal contents into the stomach are the following: (1) The placing of fat in the empty stomach; (2) the feeding of fat-rich food; (3) the presence of large quantities of hydrochloric acid in the stomach, whether at the height of digestion or from secretion of acid into the empty stomach; and (4) the presence of other acids in the stomach, such as lactic, acetic, butyric. Occasionally no cause was demonstrable. The addition of the duodenal secretions led to a destruction of the pepsin, since the gastric contents no longer showed digestion of proteins after they had been rendered acid. In a dog whose stomach was shut off from the duodenum, no digestion of fat took place. Boldyreff was able to show on himself and another person by passage of the stomach tube after taking 80 to 100 grams of oil, that the pancreatic juice had passed into the stomach. This procedure may be of use in obtaining pancreatic juice for diagnostic purposes. The observations show that after ingestion of considerable fat the digestion in the stomach is performed mainly by the pancreatic ferments, and further, that in healthy adults one need not expect to find pepsin or hydrochloric acid in the gastric contents, if there has been an admixture of intestinal juice.

A New Method for the Quantitative Determination of Pepsin.—SOLMS (*Deut. Arch. f. klin. Med.*, 1907, lxiv, 159) believes that the method he has devised is the most accurate yet proposed for the quantitative estimation of pepsin. Two solutions are required: (1) $\frac{N}{10}$ hydrochloric acid, and (2) 1 per cent. solution of ricin in a 5 per cent. aqueous solution of NaCl. Solution 2 is filtered; the filtrate is slightly turbid and becomes milky on the addition of the decinormal acid. Pepsin is capable of rendering clear a turbid ricin solution. The technique is as follows: The gastric contents are removed an hour after the Ewald test breakfast, as usual. The free hydrochloric acid, if present, is then determined quantitatively, likewise the total acidity. The gastric juice is now diluted, according to the degree of the acidity (the total acidity is taken as a guide, 40 to 60 being considered normal). With normal acidity the gastric juice is diluted 1 to 100 (to 1 to 1000); with hyperacidity 1 to 100 (to 1 to 10,000); with anacidity or marked subacidity 1 to 10 (to 1 to 100). For the sake of clearness the following examples may be quoted: With a graduated pipette 2 c.c. of the filtered ricin solution is placed in each of five test-tubes. With a second pipette 0.5 gram of decinormal HCl is added to each of these tubes, rendering the fluid very turbid. Now one adds to the first tube 1 c.c. of boiled gastric juice (ferment destroyed), to the second tube 0.9 c.c., to the third 0.8 c.c., to the fourth 0.5 c.c., and to the fifth 0 c.c. Then take the diluted gastric juice whose pepsin content is to be determined (1 to 100 dilution for normal juice) and to the first tube (containing the ricin solution, tenth normal acid, and boiled gastric juice) add 0 c.c. of it, to the second 0.1 c.c., to the third 0.2 c.c., to the fourth 0.5 c.c. and to the fifth 1.0 c.c. Thus, each test-tube contains about 3.5 c.c. of fluid. The tubes are stoppered and placed in the incubator for three hours, or at room temperature for a longer time, when they are examined; observe which of the tubes contains a clear fluid. For purposes of convenience Solms says that a gastric juice has 100 pepsin units when 1 c.c. of a 1 to 100 dilution of the juice clears the ricin solution after three hours in the incubator. In examining normal gastric juices, as judged by the acidity values, the author finds that 100 pepsin units is a normal quantity of pepsin, although with normal acidities he has obtained as much as 200 to 500 pepsin units. With anacidity and low total acidity the pepsin values were constantly low, about 10 to 20 units or less. Hyperacidity, on the other hand, does not usually show a corresponding increase in the amount of pepsin, the amount being normal generally. Thus far the author can see no aid in a diagnostic or therapeutic way to be obtained from the quantitative determination of the pepsin in the gastric contents. The method apparently marks a distinct advance in simplicity and accuracy.

Banti's Disease, with Report of Two Cases.—W. OETTINGER and N. FIESSINGER (*Revue de méd.*, 1907, xxvii, 1109) state that since Banti first described the condition named after him, about thirteen years ago, despite the interest which has been shown in it, the pathogenesis has remained somewhat obscure. Some have thought that the process arose first in the liver and subsequently affected the spleen, while others assert that the spleen is first affected, and by its close connection with the

liver by means of the portal system may transfer easily the pathological cause to that organ. It is naturally important to settle this question. If the spleen be the point of origin, splenectomy might be expected to arrest the process. In the two cases reported by Oettinger and Fiessinger this previous involvement of the spleen before alteration of the liver was definitely made out. Pathologically, the liver showed no cirrhosis beyond some sclerosis surrounding the portal veins; the hepatic veins, the biliary system, and the hepatic arteries were normal. The splenic vein from its entrance into the portal system and toward the spleen showed a marked endophlebitis, whereas the rest of the portal system, especially the mesenteric portion, was apparently normal. The spleen itself in both instances was markedly altered, and showed much sclerosis of the normal soft, pulpy portion. This change in the spleen has been shown to be due to a hemolytic process, the cause of which is not noted by Oettinger and Fiessinger; they conclude, however, from their study that these hemolytic poisons travel along the splenoportal system, as shown by the endophlebitis, and ultimately the liver is affected. These facts, they say, indicate the need of early surgical interference; splenectomy, especially in the early slow development of the disease, offers the only chance for a cure.

The Presence of Spirochetes in Pseudoleukemia, Acute Lymphatic Leukemia, and Lymphosarcoma.—W. E. WHITE and F. PROESCHER (*New York Med. Jour.*, 1908, lxxxvii, 9), having previously found spirochetes in the glands of pseudoleukemia and also in the fluid aspirated from the glands in a case of acute lymphatic leukemia, were led to work along these lines, and this study is based on fourteen cases of the above diseases, from the glands of which, whether removed from living patients or obtained at autopsy, similar spirochetes were found. From one of the lymphosarcoma cases White and Proesher were able to transfer a purely glandular affection to a guinea-pig by a subcutaneous inoculation from one of the sarcomatous glands. This they have transferred through four generations of animals, recovering in each the same organism. The spirochete differs from those previously described in its great length and the shallowness of the curves of its body, and may be seen in the freshly expressed juice of the glands or in sections stained by Levaditi's method, or in smears following the method of Proescher. White and Proescher give the name Spirochæta lymphatica to the organism, but say further study is necessary before its relation to the disease can be definitely proved. However, they have never been able to find it in normal or tuberculous glands and the fact of finding these organisms in the different members of this more or less closely allied group of diseases, and the ability to transfer one type of it to four generations of guinea-pigs and recover the organism in each case, have led White and Proescher to suggest the following classification of this disease based upon this supposed etiology: Lymphatic spirillosis: Acute form—(*a*) with lymphocytosis, and (*b*) without lymphocytosis; chronic form—(*a*) benign, without sarcomatous change or with sarcomatous change, and (*b*) malign, with sarcomatous change or without sarcomatous change.

Gumma of the Heart.—H. HUCHARD and NOEL FIESSINGER (*Revue de méd.*, 1907, xxvii, 948), on account of the lack of definite symptoms and obscurities in diagnosis of gumma of the heart, give a most careful review of the literature on the subject and report in detail a case of their own. The first reported case in the literature dates back to 1775, and subsequently many others have been reported. They are briefly summarized by Huchard and Fiessinger who note the following points: As regards etiology, males are more commonly affected than females—about 60 per cent. of 47 cases. Twenty-two of these occurred between the ages of thirty-one and forty years; the left ventricle was most commonly affected. As regards the clinical manifestations of the trouble, Huchard and Fiessinger point to no definite syndrome, but note the importance, in old syphilitics, of a history of gradually progressive dyspnœa, œdema, and cyanosis. The pulse is often small, rapid, of high tension, and at times irregular. The heart and liver may be enlarged and albuminuria and polyuria present. The gummas are so often latent, however, that few symptoms develop until sudden death occurs and the diagnosis is made at autopsy. In concluding, Huchard and Fiessinger report several cases from the literature in which cardiac conditions developing in luetic patients have been either cured or greatly improved by specific treatment associated with very little cardiac therapy, and say that this is the best proof of the diagnosis of a syphilitic cardiac affection, whether gummatous or otherwise, and that a specific form of treatment, in doubtful cases, may even help some non-luetic affections, while in the positive cases a cure which could never be reached by ordinary cardiac treatment, is attained.

Experimental Syphilis.—ELIE METCHNIKOFF (*Revue de méd.*, 1907, xxvii, 952) reviews the experimental work that has been done up to the present time on the higher apes and other animals, and the more modern methods for diagnosis. As regards prophylaxis, the use of serums, vaccines, and other things being so unsatisfactory, the author and M. Roux were led to experiment with an ointment having a mercurial base, which was found, if applied within eighteen hours after inoculation, to prevent the infection without, however, conferring any immunity against future inoculation. Of the many preparations used, the best was found to be 25 to 33 per cent. calomel, with from 75 to 67 per cent. of lanolin. After many successful experiments on animals, a final test was made with the consent of a young doctor, who, one hour after inoculation with a syphilitic virus was treated with a calomel ointment (25 per cent.), and after one year has shown absolutely no signs of any luetic disease. Metchnikoff hopes that the systematic use of this calomel ointment may reduce the great frequency of this dread disease. As regards treatment, Metchnikoff speaks of mercurial injections and also of the lately advocated use of the arsenical preparation (atoxyl), which, it may be hoped, will in future give better results.

Renal Complications and Sequels of Influenza.—H. STERN (*Medical Record*, 1908, lxxii, 46) notes that there is a lack of consideration paid to the renal troubles that may be traced to influenza, possibly owing to their slight character at first or the lack of care bestowed upon the patient

after the more prominent phenomena of influenza have subsided. Stern distinguishes three forms of complications: (1) Cases with acute symptoms of renal involvement; (2) cases in which there occurs an aggravation of a preëxisting renal disease; and (3) postinfluenzal nephritis. As regards the first group, there may be simply the usual febrile congention, such as may accompany any acute infectious disease which rapidly clears up after convalescence, but in a few cases, about 2 to 4 per cent., there may be an acute nephritis of a more or less severe type due directly to the influenza. The second variety is of decided importance as regards prognosis, especially as influenza may light up a latent nephritis, which has previously shown few or no symptoms, into a much more serious and even fatal process. The third class is of importance, especially in those cases of influenza with a long protracted convalescence; it is in this class that subsequently the signs and symptoms of renal inefficiency gradually develop. Thus, of 14 cases of protracted convalescence and general systemic decline after an attack of influenza, that were examined by the author, in from three to ten weeks after the attack, 7 showed some impairment of renal function, and 2 others definite renal disease.

Alimentary Poisons and Atheroma.—M. LOEPER (*Arch. d. maladies du cœur, des vaisseaux, et du sang*, 1908, i, 45) asserts that various organic lesions have their origin in the digestive tract, toxic products being absorbed; the cardiovascular system may be among the first to suffer from the irritant action of such poisons. He divides the alimentary intoxications into four classes: those which result from the direct poison of certain foodstuffs; those which result from their alteration and change; those arising from their putrefaction; and finally, those which result from the ultimate destruction of certain nutritive products in the tissues. The first class may come from some of the vegetables, fishes, ordinary meats, and drink; the second, from game, sweetmeats, and fowl; the third, from products of intestinal putrefaction; and the fourth from the bodily excretions, as lactic acid, uric acid, and perhaps also creatin and creatinin. Loeper's experiments with these different substances were made on rabbits with a resulting sclerosis of more or less severe degree (this is illustrated in plates), and although Loeper says the doses of these poisons may have been larger and more severe in animals than in man, yet the repeated absorption in the human being of minute doses of these poisons will result in the same condition. Knowing this to be so, he concludes that, either in health or disease, the prescription of certain diets or the forbidding of foodstuffs giving rise to the above-mentioned products may prevent or at least alleviate an arteriosclerosis that might progressively increase, an "atoxic regime" being, of course, the ideal, which, however, is hard to attain.

Along these same lines another article is that on "experimental work arteriosclerosis," by OSCAR KLOTZ (*Montreal Medical Journal*, 1908, xxxvii, 16), who notes the factor of work and increased arterial pressure on the arteries in producing sclerosis. It has been noted clinically in the adult that vessels of the more active organs show hypertrophy and sclerosis earlier than in the less active parts. In right-handed persons the radials on that side are considerably more sclerosed than on

the left, and the reverse is true in left-handed persons. The same is true for those who walk much or are on their feet frequently, the most advanced arterial changes in these persons being in the vessels of the legs. These facts all point to the prominent part played by work in arteriosclerosis. To find out whether this factor of work alone unaided by toxic agents could produce sclerotic changes, the author experimented on healthy nine-months-old rabbits by suspending them by their hind legs for a few minutes a day over a long period of time, thus causing not only increased work, but also, by the inverted position, considerable increase in pressure in the thoracic aorta above the normal, and this without the aid of drugs. At autopsy macroscopical and microscopical changes could easily be made out in the aorta and its branches above the renal vessels. There were two kinds of changes noted in the vessels, one in the intima alone, and the other in the media. In the latter type degenerative changes occur and fusiform aneurysms are formed. Klotz concludes that from these experiments work plays a very important role in the production of arteriosclerosis of different character; that even in vessels of different histological structure sclerotic changes can be brought out by increased work; and further, that as a consequence of certain changes, degenerative in character, taking place as the result of increased work in the media of the vessels, aneurysms may result.

SURGERY.

UNDER THE CHARGE OF

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A Contribution to the Study of Jejunostomy.—DELORE and THEVENOT (*Archiv gén d. chir.*, 1908, ii, 237) say that jejunostomy does not merit the discredit into which it has fallen, in the view of many surgeons. The results are good when a simple technique is employed. Preference is given to two methods of operation: the one proposed by Druebert in which a canal is made leading out from the intestine between the serous and the muscular coats of the intestine; the other proposed by Eiselberg and Witzel in which the canal is made along the wall of the intestine by plicating it over a catheter as in the similar method of performing a gastrostomy. The chief object of any method is to obtain an opening in the bowel which will be continent. It should be one that can be easily and rapidly made and one that may be only temporary.

More complicated operations do not accomplish more than these simple ones and are not tolerated as well by the enfeebled patients. Jejunostomy is indicated: in cancer of the œsophagus when the stomach is so retracted that one cannot do a gastrostomy; in cancer of the stomach when the situation and extent of the lesions will not permit a gastrostomy or a gastro-enterostomy, and when under any circumstances in such cases a gastrostomy is impossible; in gastric fistulæ, spontaneous or surgical, when the orifice cannot be closed by direct sutures and is situated in the pyloric region. In burns of the stomach by corrosive fluids, jejunostomy is the only convenient immediate treatment for the diffuse lesions. It is indicated when active ulcers cannot be removed or are complicated by acute or chronic hemorrhages, rebellious to medical treatment. Gastro-enterostomy is preferable when the ulcer is located in the pyloric region and is accompanied by stenosis of the pylorus. Jejunostomy has a physiological basis. It assures complete rest of the stomach and is indicated whenever rest is necessary for the cure of lesions of this organ.

Simultaneous Radical Operation on a Femoral and an Inguinal Hernia on the same side.—BERNDT (*Zentralbl. f. Chir.*, 1908, xxxv, 393) made an incision parallel to and immediately over Poupart's ligament, divided the external oblique from the external ring outward, isolated, ligated, and removed both the sacs of the femoral and inguinal herniæ. The spermatic cord was then lifted and the internal oblique muscle together with the transversalis were brought downward until they were visible under Poupart's ligament, when the horizontal ramus of the pubis could also be seen. A curved needle with a silk suture was then passed through the lower edge of the internal oblique and transversalis muscles, then through the periosteum of the pubic bone until the needle appeared external to the femoral canal. The other end of the suture was then passed through the lower edge of Poupart's ligament. Both ends were then caught in a hemostat. Two or three similar sutures were then introduced and all tied thus closing the femoral canal. About three more sutures were introduced according to the Basini method, to bring the internal oblique and transversalis to the lower edge of Poupart's ligament. The supermatic cord was then laid in position and the external oblique sutured over it in the usual manner.

Conservative Operations upon Sarcomas of the Long Bones.—BORCHARD (*Deut. Ztschr. f. Chir.*, 1908, xciii, 1) says that in cases of sarcoma originating in the bone or periosteum of the long bones, conservative methods of operation should receive the most consideration. It is not the microscopic picture, but the macroscopic, that is, the extent of involvement, which will decide whether or not a conservative method of treatment is to be employed. In all encapsulated tumors it is the operation of choice, and even in moderate sized, so called, infiltrative tumors it should be employed. Only when the soft parts are so extensively involved in the growth, or a part necessary to the preservation of the extremity, should the mutilating operations, excision and amputation, be considered. In the treatment of the more malignant tumors

the performance of conservative operations should be the rule, that of the mutilating operations the exception. Functional failures are not to be much feared, since the muscles can adapt themselves to extensive shortening of the bones, and since the ability of the bones to regenerate may be delayed and later go on to completion with resulting firm union. The age of the patient is not very important. In suitable cases plastic operations should be done. The simple removal of the tumor is to be permitted only when it is completely surrounded by good bone and when this remaining surrounding bone is sufficient to guarantee the firmness of the limb, or when a companion bone will supply the deficiency. A removal of a part of a joint surface will be permitted, since this can be replaced by a plastic operation. By a sufficiently extensive resection into the sound tissues, by the employment of the plastic operations at our command, and by sufficient patience, we may obtain results, which as far as their permanency and functional effect is concerned, will be far better than those to be obtained from the mutilating operations. More patients will be saved because they will undergo these operations earlier than amputations or excisions.

The Treatment of Gonorrhœal Arthritis of Large Joints by Means of Passive Hyperemia.—BAETZNER (*Deut. Ztschr. f. Chir.*, 1908, xciii, 46) says that the treatment by passive hyperemia has established an important advance in the therapy of gonorrhœal arthritis. The relief from pain afforded by it is marked. The clinical course of the disease becomes considerably milder under its influence. It permits more early movement of the joint. The duration of the disease is considerably shortened and the functional results improved. Ankylosis was not observed in any of Baetzner's cases. The treatment is simple, technically not difficult, and its cheapness makes it accessible to many cases. Baetzner believes, on the basis of his cases, that passive hyperemia should be extensively employed in the treatment of gonorrhœal arthritis.

Apropos of Total Extirpation of the Urinary Bladder.—GRAEUWE (*Jour. de chir., et. ann. d. l. soc. Belg. d. chir.*, 1908, viii, 106) reports one case in which M. Verhoogen excluded the bladder from the urinary tract, and a second case in which he did a total extirpation of the bladder with a tumor growing in it. In both cases the ureters were transplanted into the cecum and the latter isolated from the rest of the gastro-intestinal tract, a fistulous tract being made from it to the surface of the abdominal wall. The first was done in a woman, aged sixty-eight years, for invasion of the bladder by a carcinoma of the uterus. After opening the abdomen the right ureter was divided between a ligature below and a forceps above. The upper cut end was introduced and sutured into an opening in the posterior side of the cecum. The same procedure was carried out with respect to the left ureter, which was carried under the peritoneum to the cecum. A rubber drainage tube was introduced to the seat of the anastomoses, to provide against possible leakage. The ileum was then divided close to the cecum and its cecal end closed by a double continuous seromuscular suture. Then the cecum was divided and the two ends closed in a similar manner. The open end

of the ileum was then anastomosed into a lateral opening in the lower end of the ascending colon. The appendix, which was fortunately of a larger caliber than the normal, was opened, a rubber catheter introduced through its lumen into the cecum, and the appendix sutured into the abdominal wound. Fearing that later the lumen of the appendix would close, the operator attached the cecum to the abdominal wall, so that it might be opened subsequently if necessary. The abdominal wound was then closed. During the first twenty-four hours there was no trouble except that it was necessary to change the dressings several times, because they were soaked with urine which indicated leakage at the sutures. On the following day there was severe dyspnœa, and there were rales in the chest. Death occurred in the afternoon. The autopsy showed pulmonary œdema and neoplasmic foci in the two lungs. The left ureter was closed at the anastomosis, the right was permeable. The pelves of the two kidneys were much dilated, the cystic parenchyma was very anemic and showed lesions of interstitial nephritis. The second patient in whom the bladder with its tumor was extirpated, and in whom only one ureter was anastomosed to the cecum, the other being ligated and therefore occluded because that kidney was atrophied and functionless, lived only three days.

Subtemporal Decompressive Operations for the Intracranial Complications Associated with Bursting Fractures of the Skull.—CUSHING (*Annals of Surgery*, 1908, xlvii, 641) says that in most fractures of the base of the skull the symptoms are brought about by an increase of intracranial pressure, whether immediate from free extravasation due to laceration of cortical vessels, intermediate, often with a "free interval" of consciousness, when an extravasation outside the dura slowly augments in size, or late, often a matter of a few days when cerebral œdema occurs. During the last three years Cushing has followed the routine of making a subtemporal exploration through a split-muscle incision combined with a subtemporal decompression, namely the removal of a circle of thin bone, about 4.5 cm. in diameter, from under the muscle. A dural opening is also made. The former mortality was about 50 per cent. Of the last 15 cases only 2 have been lost, each from an overlooked extensive intracranial extravasation on the opposite side of the head. The advantages of this method of treatment are as follows: (1) The approach is made through the thinnest part of the skull. (2) The opening is made under the temporal muscle the fibers of which are split and not divided, so that when closed they serve to prevent too great bulging, and serve later to prevent a subsequent obtrusive depression when the normal conditions have been restored. (3) In case there has been a rupture of the meningeal or one of its branches the extradural clot is certainly brought into view by this opening, and as the meningeal vessel is exposed it can be ligated. (4) In all bursting fractures accompanied by laceration of the brain it is the tips of the temporal and base of the frontal lobes which most frequently suffer, and a subdural extravasation from this source can most readily be dealt with through an opening in this situation. (5) In a large proportion of bursting fractures the lines of fracture seek out the midcranial fossa, and hence free bleeding from the base can be

most easily drained through the temporal fossa by drains placed under the temporal lobes. (6) The subsequent œdema and swelling of the brain, which is an almost invariable sequel of any serious cerebral contusion and which is responsible in many cases for the pressure symptoms during the first two weeks, can be best combated by an opening in this situation under the muscle. (7) Aside from the prompt subsidence of the acute symptoms which are often seen after these operations, they appear to lessen many of the unpleasant late sequels, traumatic neuroses, which are so often a feature of the cases which have recovered without operation.

Fracture through the Anatomical Neck of the Humerus with Dislocation of the Head.—BUCHANAN (*Annals of Surgery*, 1908, xlvii, 659) says that fractures through the anatomical neck of the humerus associated with dislocation of the head, present features so distinctive in their mechanism of production, in their pathology, in their amenability to external treatment, and in the nature of their operative treatment, as to place them in a class by themselves. A case of this kind came into Buchanan's hands after ineffectual efforts at reduction had been made. The ordinary signs of dislocation were not present. The rotundity of the shoulder was almost completely preserved. The elbow could be applied to the chest wall and the hand placed on the opposite shoulder. The tuberosities could be felt to rotate under the acromion with the shaft of the humerus. The persistent pain and helplessness of the limb, however, indicated a serious injury and rendered an *x*-ray examination advisable. This showed a fracture of the anatomical neck with subglenoid or axillary dislocation of the head. The head was removed with difficulty by an incsion made along the lower border of the anterior axillary fold the fragment being held firmly under the axillary vessels and nerves. Examination of the patient six months after the injury showed the arm to be of normal appearance with very little wasting. Unaided abduction of the arm was possible only to the extent of about 45 degrees. By passive movements the arm could be brought, easily, almost to the horizontal. All movements of the forearm and swinging movements of the limb were satisfactory. Use of the arm was much impaired in last three months, no doubt due to neuritis of the median nerve from pressure of the head prior to its removal. Reduction of the head fragments by external manipulation has been reported, but not vertified by the *x*-ray or autopsy. Reduction by open incision has been done in but three cases, with one good result, one fair result, and one result which could be counted fair at the end of seven weeks, the time of the report. Excision of the dislocated head is the operation of choice, having been performed in 14 cases, with 2 results called excellent, 6 good, 1 moderately good, and 2 deaths to its credit.

Osteoplastic Resection of the Skull.—WOOD (*Annals of Surgery*, 1908, xlvii, 645) has so modified the Stellwagen trephine as largely to overcome the objections to its use and to make of it a very useful instrument. The various parts of the modified instrument, which is well illustrated, are as follows: (1) A T-handle, armed with a bone drill. (2) A shaft, to which the handle is adjusted, provided with a fenestrum to accommodate

the radial arm, and a blunt centre-pin at the end. The handle is held to the shaft by a spring, but is instantly released by slight traction. (3) A radial arm which is received in the fenestrum in the shaft, and is secured by a thumb screw. The knife and saw are carried at the outer end of this arm, and are held by a set screw. (4) A radial arm handle, to be adjusted to the extremity of the arm, and used to give the circular motion to the knife and saw. The arm is graduated in inches and centimeters so that it may be instantly adjusted to cut an opening of the desired size. (5) Knife and saws. Wood makes the following claims for the instrument: (1) It enables one to cut an osteoplastic flap of the skull quickly and safely. (2) No injury can possibly be done. The careless or clumsy use of the instrument can do no harm. (3) Every part may be sterilized by boiling. (4) It is always ready for use as there are no complicated parts to get out of order. (5) It is complete in itself and does not depend on electric currents, motors, assistants, or anything but the hands of the operator.

The Treatment of Dislocation of the Shoulder-joint Complicated by Fracture of the Upper Extremity of the Humerus.—Mason (*Annals of Surgery*, 1908, xlvii, 672) says that every dislocation of the shoulder associated with fracture of the upper extremity of the humerus is a grave injury, and is likely to result in serious impairment of function if not promptly treated. Every such injury should be subjected to *x*-ray examination for accuracy in diagnosis. Gentleness should characterize all manipulative efforts at reduction, and these should never be carried to the point of bruising or lacerating the tissues. Excision should only be practised when reduction by open arthrotomy has failed, or when there is extensive comminution of the upper end of the humerus, or when in fracture of the anatomical neck, the condition of the upper fragment does not justify a reasonable expectation of uniting. After reduction the broken greater tuberosity should be nailed into position if the case is recent, and should be removed if it causes impairment of function in an old case. Failing to reduce by manipulation, immediate arthrotomy with reduction of the dislocation, followed by appropriate treatment for the fracture, has given the best results, and is the ideal method of treatment. Rigid asepsis is essential in securing good results, and these operations should not be undertaken when this cannot be carried out.

Some Remarks on the Testicular Manifestations of Gonorrhœal Origin.—Dind and Metraux (*Annal. d. mal. d. org. genito-urin.*, 1908, i, 346) say that if the epididymis is the result of infection transmitted by the blood, there should be preceding general symptoms indicating the presence of the infection in the brood. But those are generally absent until the epididymis is developed. As the operative treatment increases it will probably show a greater number of cases in which the gonococcus can be demonstrated. Andry accounted for suppuration in epididymitis by assuming that extension occurred by way of the lymphatics of the spermatic cord and epididymis. Sprecker, Hartung, and Witte have found the gonococcus in abscesses of the epididymis. Baermann found that the abscess was the result of the same organisms

as those producing the urethritis, the gonococcus or others. Schindler recommended in grave febrile cases, with pronounced local infiltration, that the organ be punctured, and suggested that the punctures may be multiple. This treatment gives much relief, lowers the temperature, and decreases the infiltration. This is due to relief of the congestion from the subcutaneous hemorrhages which result. Dind and Metraux did not obtain good results from this method of treatment. They prefer an incision into the inflamed organ, which should be on the dorsal surface of the epididymis, 2 to 3 cm. long, going through the skin, fascia, and superficial layers of the epididymis. This permits an inspection of the tissues, when one may find either a diffused inflammation or intense congestion. The incision gives much hemorrhage and generally exposes some evidence of pus. One may find that the inflammation has become localized, and that one or more purulent foci are distributed throughout the organ, with fungous or necrosed walls. After rubbing away the purulent material with gauze or a blunt curette and arresting the hemorrhage the wound may be sutured, leaving in a gauze drain for twenty-four hours. The operation can be done under cocaine and gives excellent results.

THERAPEUTICS.

UNDER THE CHARGE OF

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ASSISTED BY

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Diet in Gout.—SIKES (*Practitioner*, 1908, lxxx, 396) states that there seems to be a general tendency toward the recommendation of a simple mixed diet for the average patient. Also, it is now customary to modify the diet more to suit the individual digestion than to prescribe one that is free from this or that chemical element, as, for example, the quantity of purin. In average patients meat need not be forbidden, but the amount should be restricted to one meat meal in the day. We are coming more to consider the carbohydrate element of the food, and its effect on the liver, as of more importance than was formerly the case. Hence it is advisable to reduce the amount of carbohydrate which is taken in the comparatively pure form, such as potatoes, rice, etc. If we wish the digestion to proceed as normally as possible, and to avoid the absorption of imperfectly elaborated products, it is only rational to prevent the undue dilution of the gastric juice, conse-

quently liquids during meals should be restricted as much as possible. Simple meals, limitation of carbodydrates, restriction of alcohol, and the drinking of non-alcoholic liquids between meals are the important points.

The Therapeutic Value of Oxygen Inhalations.—BUREAU (*Gaz. méd. de Nantes*, 1908, xxvi, 161) considers that oxygen inhalation is a most effectual means of combating asphyxia. In certain patients, particularly in bronchopneumonia of infectious nature, influenzal or otherwise, with marked cyanosis, the action of this therapeutic measure is most beneficial. The inhalations are also of some service in the asphyxia of tuberculosis. In other asphyxias their action is dubious. The oxygen should be administered in large amount, the quantity to be regulated by the condition of the patient. The gas should be inhaled until the cyanosis has disappeared, and the patient should be kept under the surveillance of an observer sufficiently experienced to recognize the indications for the renewal of the inhalations, that is, upon the first evidence of a renewal of the cyanosis.

The Roentgen Rays in Cutaneous Epithelioma.—DUBREUILH (*Jour. de méd. de Bordeaux*, 1908, xxxviii, 133) cites a number of instances of epithelioma which, he states, show the importance of flexibility in therapeusis. It seems certain that the *x*-rays are able to cure cutaneous epitheliomas, but it is just as assured that this agent cannot cure this affection in every instance; between these two extremes there are patients to whom the rays are capable of conferring considerable benefit, though not complete cure, if the operator knows how to adapt the treatment to the patient in hand.

Prophylactic Treatment by Bacterial Inoculation. RITCHIE (*Edinburgh Med. Jour*, 1908, xxiii, 295) considers that this form of prophylactic treatment, in the ordinary sense of anticipating infection, has enormous possibilities. We are, however, faced with the difficulty of not always knowing what organisms we have to combat. This difficulty, in the case of wounds, operative or accidental, is more apparent than real. If we give a dose of $\frac{1}{4000}$ to $\frac{1}{1000}$ mg. each of Staphylococcus aureus and Streptococcus pyogenes, and also of Bacillus coli, if in the region of a mucous tract, we shall probably cover most eventualities, for other infections are usually secondary. Ritchie gives such an inoculation in all operations with, so far, satisfactory results. In accidental wounds, too, we can similarly control, if not wholly prevent, suppuration.

The Treatment of Chilblains.—GARDINER (*Practitioner*, 1908, lxxx, 251) advises (1) constitutional treatment, consisting of iron, cod-liver oil, and tonics when indicated, the nitrites if there is tendency to angioneurotic disturbances, and, in urticarial patients, the administration of calcium chloride in doses of 15 grains three times daily; (2) local treatment. Foot and hand wear should be loose, warm, and non-irritating, Massage is helpful as a prophylactic, and as local applications ichthyol and formalin are of preëminent value. The former may be used in 10 to 20 per cent. strength with lanolin as an ointment. Spread on linen and worn at night, it often dispels a threatened attack. Formalin should not be

used in the pressure of abrasions, but in their absence may be applied as an ointment of from 10 to 50 per cent. strength, depending on the susceptibility of the patient's skin. If its astringent action goes too far and the skin becomes cracked, the formalin should be stopped and vaseline or lanolin applied. Electricity in the form of galvanism, faradism, the *x*-rays, and the high frequency current are often useful. In the ulcerating stage an ointment consisting of mercury ammoniate, 5 grains; ichthyol, 10 minims; powdered starch and zinc oxide, each 2 drams; and vaseline, ½ ounce, is recommended. Patients who resist the various measures mentioned are likely to have lupus erythematosus and not chilblains.

The Scope of Therapeutic Inoculation.—SANBORN (*Boston Med. and Surg. Jour.*, 1908, clviii, 484) emphasizes the necessity, in attempting the treatment of a number of patients in a general hospital by bacterial vaccines, of being familiar with, and having the laboratory equipment needed to make use of, not only procedures for determining opsonic indices, but also the other methods which may be applicable in the study of questions that arise in the immunization of special patients; with methods of treatment which will act as adjuncts to the bacterial vaccines without access to the laboratory when certain information is needed, is unsatisfactory, and may be a source of damage to the patient, though many infections may be treated with clinical symptoms alone as a guide; on the other hand, the extreme of using the opsonic index to guide, without reference to clinical symptoms, is equally unwise and unscientific. For the successful application of immunization methods one must not only be well grounded in the biology of the infecting agents, their methods of attack within the body, the machinery that the body sets in motion to destroy them, and the effectual procedures to assist the body in its struggle, but also should have the broadest clinical training, in order that the relations of the laboratory and the clinic may be close; that the one may supplement the other in the interest of the individual patient.

The Mixed Toxins of Coley in Leukemia.—LARRABEE (*Boston Med. and Surg. Jour.*, 1908, clviii, 183) has used the mixed toxins of streptococcus and Bacillus prodigiosus in four instances of leukemia. One of these showed a degree of improvement amounting to symptomatic recovery which has lasted for upward of four months. Another patient showed considerable temporary improvement; a third showed improvement in weight and general condition only. An instance of acute lymphatic type was uninfluenced. Although two are still under treatment, there does not appear to be much hope of permanent cure. With the effects sometimes obtained with the *x*-rays, the author is unable to say that the toxins compare favorably. The toxin treatment is decidedly more painful and dangerous, but it has the advantage that it can be used in many patients when radiotherapy is not available. The conclusion is that the results have been encouraging enough to warrant further trial.

Retrorectal Injections of Artificial Serum in Incontinence of Urine.—JABOULAY (*Tribune médicale*, 1908, xli, 202) has been able to influ-

ence favorably instances of this condition by means of injections of normal saline solution in amount up to about 6 ounces. The needle is inserted just anterior to the coccyx, a finger having been placed in the rectum in order to protect this viscus. To obtain the best results of the treatment several injections may be necessary, and when the affection is due to such causes as preputial adhesions, etc., the treatment is not indicated, but in those forms of incontinence of which the causation is not obvious the injections afford distinct relief, although they may not prove absolutely curative.

The Thymus Gland Treatment of Cancer.—GWYER (*Annals of Surgery* 1908, xlvii, 506) believes that all patients suffering from cancer should be operated upon if the condition permits, and that at present there is no remedy which offers so much chance of cure as does the knife. The value of thymus will be found in the treatment of patients after unsatisfactory operation, such patients as those in whom, at the time of operation, we feel that the entire disease has not been eradicated. Inoperable and advanced cases will be benefited, their lives prolonged, and made endurable, and some may be so improved both locally and constitutionally that operation may become feasible. It would seem that either the action of the thymus continues for a fairly long time, or it so alters constitutional conditions that the tendency to growth is stopped.

The Action of Radium on the Blood.—AUBERTIN and DELAMARRE (*Tribune médicale*, 1908, xli, 170) have studied the modifications of the blood produced by the action of radium on white mice. In about an hour leukocytosis appears, which rapidly gives place to leukopenia, which lasts for some time, but ultimately disappears. If repeated applications of the radium are made, the leukopenia continues and the red cells are diminished in proportion. The spleen presents degenerative changes analogous to those produced by the *x*-rays. The blood changes take place earlier than do those in the spleen, and short exposures may cause no splenic lesion whatever; here the leukopenia is not due to the degeneration of the lymphoid veins. Radium seems to act upon the deep-lying organs (and especially upon the hemopoietic system) in the same way as do the *x* rays.

Colloidal Metals in Therapeutics.—DE COSTER (*Revue médico-sociale* 1908, xii, 8) draws the following conclusions from an extensive review of this subject: (1) From a physiological standpoint, colloidal metals are very easily absorbed, no matter what their mode of introduction; they are eliminated by the kidneys and are devoid of toxicity. They produce a thermic reaction, probably the result of increased activity in oxidization, especially in reference to the liver. (2) From a bacteriological standpoint, the nature of the metal employed is important; silver appears to be the most active of those studied. The bactericidal power of the metal is strong in proportion to the perfection of the solution of the metal. (3) From a therapeutic standpoint two series of observations have been made: the first on infectious diseases treated by intravenous, subcutaneous, and intramuscular injections. These injections always caused thermic reactions, characterized first by a rise of temperature, later by a very constant fall. The second series of

observations concerned the local action of the metal upon abscesses and localized infections due to pathogenic microörganisms. Colloidal silver showed itself particularly active in infections due to the streptococcus, the staphylococcus, Bacillus pyocyaneus, and the pneumococcus.

The Treatment of Ophthalmia Neonatorum.—Mayou (*Practitioner*, 1908, lxxx, 354) advises the following treatment: In infections of any severity a 2 per cent. solution of silver nitrate should be painted once daily over the lids and fornices. In mild instances, 10 per cent. protargol may be substituted, but the silver salt is much to be preferred. In the intervals of its application the conjunctival sacs should be washed out every hour with 1 to 8000 mercury bichloride. This should be used cold, or even iced, since the cold inhibits the growth of the gonococcus, and at the same time prevents excessive swelling of the lids. The silver nitrate should be rubbed into the conjunctiva of the tarsus and fornix, so that the drug may reach the bottom of the papillæ, but care should be taken not to damage the corneal epithelium. The excess of silver should be neutralized with salt solution. The nurse should be careful against infecting herself. If only one eye is affected, the sound eye should be covered by a shield, or, better, in infants, by cyanide gauze sealed on the nasal side by collodion, or strapping. It should be inspected for the first few days to see if infection has taken place. The treatment should be continued, at least with the lotion, for a month after all discharge has ceased. Mayou has employed antigonococcic serum (horse) in the early stages in four patients, with the idea of trying to shorten the disease, but without definite result.

Viscum Album in the Arterial Hypertension and Albuminuria of Pregnancy.—Oliveau (*Quinzaine thérapeutique*, 1908, ix, 53) advises the administration of viscum album (mistletoe) in connection with milk diet in this condition. The latter is insufficient to control the symptoms in many instances, and the result is better if the misletoe, which acts as a reducer of arterial tension, is also prescribed. An aqueous extract of the drug is made by adding to 2½ drams of the dried leaves of viscum album 6½ ounces of boiling distilled water, 5½ grams of sodium chloride; 15 minims of this preparation is injected every twenty-four hours, and, with a milk diet, this form of treatment is said to be quite effective.

PEDIATRICS.

UNDER THE CHARGE OF

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A Case of Hirschsprung's Disease, Healed by Entero-anastomosis—Germer (*Deut. Zeit. f. Chir.*, 1907, lxxxix, 385) reports the case of a boy, aged four and a half years, who had difficulty in defecation ever

since his birth; for days he had no bowel movement, and when he had a stool, it was scant and liquid. During the last six months the abdomen had gradually enlarged, until at the time of observation it measured 67 cm. and was of board-like tension. The abdominal and thoracic organs were pushed upward and the abdomen occasionally presented visible peristaltic waves, which demonstrate a markedly dilated colon. The finger introduced into the rectum entered a tremendously dilated gut, the walls of which could not be felt. A rectal tube was inserted, and during the next few weeks the bowel was irrigated twice daily and abdominal massage was practised; much fecal matter was removed, and at the end of the first week the abdomen measured but 57 cm. and the patient seemed considerably better. The visible peristalisis continued, however, and as the abdomen diminished in size a doughy tumor could be made out in the right iliac fossa, which was believed to be fecal material, which the weak intestinal muscle could not move. As symptoms of intoxication developed partly due to a preëxisting bronchitis, an operation was resorted to. The large intestine was found tremendously dilated up to the ileocecal valve, and an anastomosis was therefore performed between the ileum and the lower part of the sigmoid. The patient recovered completely; five weeks after the operation he had voluntary stools and his abdomen measured but 47 cm. Germer calls attention to the importance of cleansing the bowel as much as possible before the operation, to the value of abdominal massage before and after the operation, and to the necessity of using perfectly healthy loops of intestine for the anastomosis.

The Symptomatology and Etiology of Barlow's Disease.—ESSER (*Münch. med. Woch.*, 1908, iv, 896) reports a number of cases of Barlow's disease occurring in children who were kept for some time on milk furnished by the city of Bonn. There were 9 girls and 4 boys, varying in age from seven to fourteen months. The symptoms consisted of diminution of appetite, pallor, pain upon being lifted or touched, swelling and deformity of the thighs, bleeding from the gums, ecchymoses, hemorrhage into the cellular tissues about eyes, and hematuria. The blood picture showed an excessive hemoglobinemia, some oligocythemia, poikilocytes, macrocytes, microcytes, normoblasts, polychromatophilia, and basophilic granules within the red corpuscles. The latter were noted especially during the stage of improvement in all the cases. In no instance was a disturbance of leukocytes reported. The milk given the children was sterilized for ten minutes at 102° C., the steam passing through under a pressure of 1½ atmospheres; the process now simply consists of steam at from 98° to 100° passing through for three minutes. The cause of the disease Barlow finds is too long sterilization, as it produces certain toxic substances at the expense of some of the food molecules. All of the patients recovered as soon as anti-scorbutic treatment was ordered and the sterilized milk replaced by raw milk. Recovery resulted promptly in the case of a child, in which the hemoglobin had fallen to 20 per cent.

Intussusception and its Cause.—W. L. WALLACE (*Jour. Amer. Med. Assoc.*, 1908, l, 1177) reports the case of a boy of three who had a hydrocephalic head and a crooked spine. He had complained of

abdominal pain for a week, and had vomited repeatedly during the preceding twenty-four hours, the material vomited being a thin bloody substance. He was shocked, markedly thirsty, and absolutely constipated. A diagnosis of high intussusception was made; the operation revealed a small enteric intussusception at the ileocecal valve, and a complete sausage shaped intussusception in the jejunum. Five weeks later complete obstruction occurred again, and adhesions were found tying the bowels to the mesentery at the jejunal site; the same condition recurred eight months later and six weeks thereafter obstruction occurred again. Immediate operation revealed a blocking of the bloodvessels of the mesentery and a marked distention of the corresponding segment of the bowel; the intestine above this was pushing into it as if trying to reinforce the weak segment by the invagination. Wallace refers to the two theories of the cause of intussusception: spasm and paralysis. His case supports the latter theory; the spasm precedes the invagination, tiring the bowel out so that paralysis is the result and this then is followed by the invagination. The paralysis also interferes with the peritoneal blood supply, and this sets up enough peritonitis to produce adhesions and prevent spontaneous reduction.

Pemphigus Neonatorum Simplex Congenitus.—A. LABGARDT and J. WALLART (*Ztschr. f. Geburtsh., und Gynäk.*, 1908, lxi, 600) have been able to collect 13 cases of non-syphilitic, congenital simple pemphigus from the literature; the first case dates back to 1794. They are able to add 3 of their own to this small list. In 2 of their cases the eruption was general, consisting of vesicles of various sizes surrounded by a red areola; the vesicular contents were serous, seropurulent, and purulent; in the third case there were but two large vesicles over the upper eyelids. In one of the cases staphylococci and streptococci were cultivated from the vesicular contents. In two of the instances the mothers were perfectly well, while in the third there was a small suppurating wound, enlarged glands at the elbow and in the axilla. The vesicles dried up promptly, the children remaining well thereafter. In none of the cases was there the slightest indication of syphilis in either mother or child. The cause of the disturbance in their opinion is in most cases a transference of microörganisms from mother to child; in other instances a sore throat or other slight infection of the mother may give rise to a toxemia, which is of sufficient intensity to induce an exanthem in the fœtus.

Ophthalmia Neonatorum: An Experiment In Treatment.—A. N. WALKER (*Lancet*, 1908, i, 1267) recommends the following vigorous treatment in all incipient cases of ophthalmia neonatorum; the method was first employed in the cases of a physician and two nurses who had been attending ophthalmia cases: As soon as it was noted that their eyes were injected and that they were discharging a thin mucopurulent secretion, a 0.5 per cent. solution of zinc chloride was dropped into the eyes at frequent intervals for twenty-four hours, and this was followed the next day with a 25 per cent. solution of argyrol. All three patients recovered within forty-eight hours. In England all births must be reported to the proper authorities within thirty-six hours, and a lady inspector must visit all the cases attended only by midwives or handy

women. If a baby is found with discharging eyes medical aid must be had at once, and if the discharge is diagnosticated as gonorrhœal, an ambulance furnished by the city conveys mother and baby to an isolation ward in the ophthalmic hospital, where the above-mentioned treatment is carried out. In nearly all instances the result is very satisfactory as compared with the older method; the average time of recovery for patients treated in the hospital, according to the older method, is two months.

Pathology and Treatment of Inguinal Hernia in Children.—C. H. FAGGE (*Lancet*, 1908, i, 1270) reports having operated successfully upon 78 children suffering with inguinal hernia. All cases of hernia, he says, are primarily due to a developmental defect, either partial or complete persistance of the embryonic processus vaginalis. This refers not only to what is usually termed "congenital hernia," but also to hernia said to be induced by marked straining, coughing, phimosis, etc.; the patent funicular process is the chief factor in all cases. The only condition that may cause some difficulty in diagnosis is congenital hydrocele. The latter is irreducible with the child in the upright posture, the fluid returning to the abdominal cavity spontaneously when the child lies down and returning slowly to the scrotum when the upright position is again resumed. Circumcision neither prevents nor cures a hernia; a truss must be applied as soon as the hernia appears; it must be worn every day and in some cases even at night, and it is only after several years that in a few cases a cure will be obtained. Indications for operation are: (1) Herniæ which cannot be kept up by trusses, or which are painful when a truss is worn; (2) large scrotal herniæ, which have stretched the inguinal canal considerably and therefore render trusses necessary throughout life; (3) the association of an undescended testicle with a hernia; and (4) a hernia which has been irreducible on a previous occasion. Taxis should never be attempted. Strangulation is an immediate indication. The operation may be performed during the first months of life and is usually well borne then. Sometimes early operation has advantages: secondary changes in the neck of the sac and in the posterior wall of the inguinal canal have not taken place yet. He described the technique and results in detail.

OBSTETRICS.

UNDER THE CHARGE OF

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High Rectocele after Perineal Repair.—DICKINSON (*Amer. Jour. Obstet.*, March, 1908) draws attention to this condition, and believes that it can best be prevented by digital rectal examination of the septum before anesthesia, to determine the condition of the tissues before they

are relaxed with ether. The operator can then decide how high up the weak spot in the rectovaginal septum extends and where the edges of the muscle are. To determine how large a surface should be denuded, artery forceps are attached to the lowest recognizable end of the hymen on both sides. These are brought together over the tips of two fingers until a snug fit is obtained. The forceps are then left in place, but dropped. The second pair are attached to the lateral walls of the vagina, and make the same test, while the fifth clamp catches the farthest spot of the rectocele. With the clamps in position, the knife outlines the area to be denuded, and the clamps may then be removed before suture. To determine the edges of the fascia and muscle, a ball of gauze is inserted into the rectum and pressed forward to carry the rectal wall forward. The upper edge of the sphincter is easily found and the stitches are placed. Before tying the stitches they should be drawn up so that the raw surface is closed. The ball of gauze in the rectum is then brought down against the newly closed tissue. If it cannot pass, it is inferred that the closure will be successful. Women over fifty or sixty years, whose tissues are prematurely relaxed, should take especial precautions after operation. When the pelvic floor has become atrophied especial precautions are also necessary, as in the case of those patients in whom the rectum is habitually distended, or in whom there is especial resistance at the anal opening. Such patients should have their convalescence prolonged for three or four weeks, enemas of oil should be given at evening to be retained until the morning to secure a soft movement, and the patients should avoid corset pressure or heavy skirts. Care should also be taken to guard against irritability of the sphincter muscle of the bowel.

The Importance of Rest in the Puerperal Period.—Martin (*Monatssch. f. Geb. und Gyn.*, 1908, xxvii, Heft 2) studied 100 cases in the puerperal period, with the idea of determining the influence of rest or motion after labor. By getting up, Martin understands that the patient sits quietly in a practically upright position, with a firm bandage around the abdomen. Such patients are not allowed to move about freely, nor to do any special work with the hands and arms. These patients leave their beds from fifteen to twenty-four hours after the completion of labor. In the next seven days they are allowed to be out of bed two hours in the forenoon and two hours in the afternoon. If the pulse or temperature rises, or any disturbance occurs, they are forbidden to sit up. When gonorrhœa has been present, patients are not allowed to sit up so early, but must remain recumbent until the pulse and temperature have become normal. Among these patients there were 62 primiparæ and 38 multiparæ. Infection developed on the third day in 4, on the fourth day in 2, on the fifth day in 5, and on the seventh day in 1. In the last case the contents of the uterus showed the presence of gonococci, and in the other cases, streptococci, staphylococci, or diplococci were present. In some of these cases the pulse on the sixth or seventh day was comparatively higher than the temperature. In but one patient did the temperature rise above 102.5° F.; and in none of the cases did fever last longer than two days. The morbidity of the series was 13 per cent. Involution proceeded well and in no case was it necessary

to use ergot to hasten the process. On the seventh day the uterus was anteflexed and the size of a small fist. The advantage in this treatment is seen in the improved emptying of the intestine and bladder, as patients were spared the use of cathartic medicines and the catheter. No influence upon the ability of the mother to nurse her child could be detected. The younger women improved very rapidly, none of them was faint, and all looked much better for the change in posture. In none of these cases was there an abnormal position or dislocation of the uterus, nor could there be observed any tendency to prolapse of the vagina or uterus. It is sometimes alleged that the early assumption of the upright posture is followed by an increased danger of embolism. The statistics of large numbers of hospital patients who have gotten up early do not show that such has been the case. The precaution is taken to watch the pulse, and should this become rapid the patient is obliged to lie down. As regards the development of infection in 1000 cases treated by the usual method of prolonged rest, the morbidity from infection was 18.5 per cent. In the present series of cases the entire morbidity was 13 per cent. It is obvious that if a patient were infected, and moved about soon after labor, such motion must tend to spread infective bacteria throughout the tissues. Puerperal patients should not get up early unless preëxisting infection can be positively excluded, and the patients are under medical control.

Labor Obstructed by an Ovarian Dermoid Retained for Two Years in the Pelvis.—DORAN (*Jour. of Obstet. and Gyn. Brit. Empire*, February, 1908) reports the case of a patient who was found to have a pelvic tumor during her third stage of labor. The attending physician succeeded in pushing the tumor out of the pelvis, and the child was born living. Six weeks after confinement, the patient had sharp pain in the right iliac region, suggestive of appendicitis. This pain subsided, but the patient was found to have in the pelvic cavity a firm elastic mass which had displaced the uterus forward. She declined operation. About eighteen months afterward the patient returned for operation, stating that she had frequent attacks of abominal pain which was very acute. The pelvic tumor was found to be a dermoid of the right ovary, weighing one pound, five ounces. It was twisted with two turns of the pedicle from left to right, and was livid through the engorgement of its veins. The tumor had fallen back behind the uterus and left ovary, which were pushed upward and forward. When the pedicle was untwisted the lividity disappeared, but the tissues of the pedicle were free from atrophic changes. There were no adhesions, and the appendix was normal. The tumor was readily removed. It contained about one pound of grease with hair of a light auburn color. The tumor had remained in the pelvis for two years without contracting adhesions, and, although it fitted closely into the pelvic cavity it had undergone rotation upon its axis. The torsion was partially reduced at the end of each attack. As the pedicle was upon the right side, the pain naturally suggested disease of the appendix.

GYNECOLOGY.

UNDER THE CHARGE OF

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Adenomyoma of the Uterus.—T. S. CULLEN (*Jour. Amer. Med. Assoc.*, 1908, l, 107) reports 22 cases of adenomyoma that he had examined previously, and states that he has been surprised by the frequency of these growths, 5 per cent. of all myomas proving to be of this character. He pays tribute to von Recklinghausen for his masterly work on this subject, published in 1896. These growths, containing gland elements and myomatous tissue, form a distinct type of neoplasm that is easily recognized microscopically. The mucosa is usually smooth and has an incact epithelium. The glands appear normal, but the stroma of the mucosa is often œdematous or rarefied. The diffuse thickening in the uterine wall consists of the characteristic myomatous tissue, but the muscle bundles are much more interlaced than in ordinary myomas. Along the border of the growth the myomatous cells gradually blend into the muscle cells. Usually the mucosa is not encroached upon, but, on the contrary, is seen to have prolongations or even isolated portions ("islands") in the myomatous tissue, with the stroma always visible between the epithelium and the myomatous tissue. Although associated with carcinoma of the cervix and body of the ureters in 5 of the 73 specimens he has examined, Cullen agrees with von Recklinghausen and Welch in concluding they are benign tumors, for which Welch proposed the name "adenomyoma diffusum benignum."

Myomectomy or Hysterectomy.—JAMES N. WEST (*Amer. Jour. Obst.*, 1907, lvi, 700) states that he has performed myomectomy on 31 patients, 2 of whom died, and that during the past three years he has done 40 consecutive, successful hysterectomies for fibroids of the uterus. Pregnancy followed myomectomy in 4 cases. West opposes the principle of removing all fibroids, and gives the following reasons for surgical treatment of them: (1) Great size, causing visceral changes, exhaustion, and inconvenience; (2) rapid growth or pain and hemorrhages, indicating that the tumor may be malignant; (3) pressure upon ureter, bladder, rectum, or intestine, interfering with the function of these structure; (4) hemorrhage, which cannot be controlled except by radical operation; (5) interference with labor, as in a tumor so situated in the pregnant uterus as to make normal labor impossible; (6) causing sterility, as when a tumor causes frequent abortions or prevents fecundation; (7) pedunculated tumors, or indications of necrosis; (8) various complications may exist in coincidence with the tumor which, taken together with it, will prove sufficient indication for operation. He urges myomectomy in a liberal portion of the operative cases.

The Relations Between the Ovaries and the Uterus.—F. DAEL (*Surg., Gyn., and Obst.*, 1908, vi, 153) believes his experiments on guinea-pigs and white rats disprove Fraenkel's conclusions that menstruation is caused by the secretory action of the corpus luteum; that it is not the pressure of the growing follicle upon the ovarian nerves, but the action of the corpus luteum, that causes menstruation, and that that structure causes every four weeks the cyclical hyperemia of the uterus which leads either to pregnancy or to menstruation. Dael states that: (1) The assumption that, after rupture of the follicle, the development of the corpus luteum produces menstruation compels one to assume, furthermore, that the maturation and rupture of the follicle and menstruation are in a regular causal relation to each other, which would contradict the extensive observations of Leopold and Mironoff; (2) as in animals rut continues for weeks, whereas, in the human, menstruation is concluded in from two to five days, we must logically, on the basis of Fraenkel's hypothesis, see the cause of this phenomenon in the fact that in animals several follicles undergo maturation and burst, consequently forming several corpus lutea in succession, thus making the specific action (not only of the vasomotor reflexes) continuous. Dael believes he is justified in the conclusion that even if the theory of Fraenkel is confined to the statement that the origin of menstruation and of rut is to be ascribed to the specific action of the internal secretion of the corpus luteum, this function of the corpus luteum is, at the present stage of researches, to be regarded as an hypothesis only. His experiments led Dael to state that bilateral ovariectomy in the pregnant animal always interrupts pregnancy during more than the first half of its duration. It is well known that this deduction does not apply to the human subject, as in women pregnancy at various stages has thus been tested and found quite able to resist such influence.

Temporary Ureterovaginal Fistula after Panhysterectomy for Fibroid of the Uterus.—ERNEST JONAS (*Amer. Jour. Obst.*, 1907, lvi, 132) reports a case of this kind that healed spontaneously. It developed a few days after operation, and was easily differentiated by following the recommendation of Völker and Joseph to inject into the gluteal region 4 c.c. of a 4 per cent. solution of indigo carmine and twenty minutes later inspect the mouths of the ureters, which demonstrated that no urine was entering the bladder from the affected side. In this examination Jonas noticed a ureteral contraction similar to that when urine is discharged from the ureter, but none was being forced out. Jonas regards this as a very important differential point between complete and partial severing of a ureter. Jonas prefers complete to partial hysterectomy for uterine fibroids, and makes a plea for delay in operation for such fistula.

The Influence of the Central Nervous System in the Causation of Uterine Hemorrhage.—H. EHRENFEST (*Gyn. Trans.*, 1907, xxxii, 522) believes many cases of uterine hemorrhage are not due to pathological conditions of the uterus or other pelvic organs, but to impulses from the central nervous system. But such influences Ehrenfest holds must be limited to the following physiological and histological facts: (1) The blood circulation in the uterus in a very marked degree stands under

the influence of the vasomotor system, the uterus being an erectile organ. (2) The uterine musculature shows rhythmic spontaneous contractions. (3) Changes in the tonus of both the uterine musculature and vessel walls are subject to the influence of the central nervous system. (4) Uterine contractions at times (as when the impulse reaches the uterus by way of the nervi erigentes) is accompanied by active vasodilation. (5) The sudden cessation of a menstrual flow or a temporary amenorrhœa developing as the result of an emotion, or in the course of certain diseases of the nervous system, often cannot be due to organic lesions in the uterus or ovaries. (6) The sudden appearance of hemorrhage as the result of a mental shock can not be explained, like the menstrual flow, as immediately due to certain degenerative processes in the walls of the endometrial vessels. (7) A sclerosis of some of the arterial vessels must be considered a physiological condition in a multiparous uterus.

Scopolamine-Morphine Anesthesia in Gynecology.—Emil Ries (*Amer. Jour. Obst.*, 1908, lvii, 204), after operating 414 times, about half of which were abdominal sections, makes the following statements: From the time of the first injection to the beginning of the operation the patient should be kept very quiet in a dark room to induce sleep. During the operation the patient may appear to be sleeping and yet be quite able to hear conversation. If aroused during operation, all surgical procedures should be suspended until the patient is again quite. In about three-fourths of his cases ether or chloroform inhalation was necessary. The vomiting in such cases was 60 per cent. when chloroform was used, and but 36 per cent. when ether was employed.

The Degenerating, Complicating, and Associate Conditions in 3561 Cases of Fibromyoma of the Uterus.—Stephen E. Tracy (*Surg., Gyn., and Obst.*, 1908, vi, 246) has carefully studied the statistics of 3561 cases of fibromyoma of the uterus reported by others and finds complications recorded 1147 times. Of the 114 cases of degenerations noted 74 (64.9 per cent.) occurred after the age of forty years. Cancer was found in the body of the uterus 63 times, and in the cervix 25 times. Chorio-epithelioma was present in 2 and sarcoma in 54 of them. Thus malignant degeneration of the uterus existed in 144 (4 per cent.) of the cases. Tracy concludes: (1) A large percentage of fibromyomas of the uterus undergo some form of degeneration, but the majority (64.9 per cent.) of degenerations take place in women who are forty or more years of age; in other words, after the menopause. (2) Fibromyomas of the uterus and visceral degenerations are found associated in a large number of cases. (3) Young women who are anxious for maternity and possess small tumors which are causing no symptoms, need not be subjected to operation, but should be instructed to report for examination as soon as symptoms develop. (4) All fibromyomas of the uterus which produce symptoms, regardless of the age of the patient, and all fibromyomas in women forty or more years of age, should be removed when diagnosticated, because the mortality following operation, below 5 per cent., is less than the risk of carrying the tumor, as from 12 to 14 per cent. of these patients would die if not subjected to operation. (5)

Supravaginal hysterectomy is the operation of election because of the ease and rapidity of its execution, and because it is followed by the lowest mortality; it should be performed in all cases in which a myomectomy is not indicated and in which panhysterectomy is not demanded. (6) Many of the associate conditions would cause death if the patients were not subjected to operation, but the mortality in these cases should not be added to the estimated mortality of fibromyomas, as they are independent lesions and in no way connected with the tumor except that the conditions co-exist. (7) A thorough pathological study should be made of all fibromyomas of the uterus which are removed, because of the malignant changes and the degenerations which take place in these tumors.

Intestinal Occlusion Following Extirpation of Uterine Fibroids of Large Volume.—J. BOECKEL (*Ann. de gyn. et d'obst.*, 1908, v, 154) reports a case of this character in which he removed an old uterine fibroid mass weighing more than twenty-four pounds by total abdominal panhysterectomy, and in which ten days later for intestinal occlusion he was obliged to re-open the abdomen and relieve an angulation of the transverse colon and do a colopexy. The angulation was in the pelvis and the arms of the V-shaped transverse colon were directed toward the splenic flexure and the cecum.

Regression and Calcareous Degeneration of Carcinoma.—B. H. WELLS (*Amer. Jour. Obst.*, 1908, lvii, 403) reports a case that he saw first in December, 1898, in a married nullipara aged thirty-three years. She had noticed for a year a painful tumor of the uterus. Wells found the uterus was immovable with the fundus extending about two inches above the pubes and rough, irregular, and nodular in outline, and bleeding followed the examination. Upon abdominal section the nodules thought to be cancer were found to extend into the broad ligament and to adherent coils of intestine and omentum. Nothing was removed except a small nodule which microscopically was found to be adeno-carcinoma. June 25, 1903, Wells saw the patient again. She stated that after operation she had improved for several months and then failed materially. At this time the disease was found proliferating in the vagina. From November, 1903, to the date of her death, March 22, 1905, she suffered from hemorrhages, but at the latter date the masses in the abdomen had practically disappeared. At the autopsy the peritoneum covering the intestinal and parietal wall was studded with small, round, hard, white particles varying in size from that of a mustard seed to that of a bean. The mesentery was a dense, fibrous mass several inches in thickness and was covered with masses of little particles. The pelvis was empty with no evidence of the uterus, tubes, or ovaries. There was no mass in the vagina, and its mucosa was everywhere smooth. The small particles removed were examined by Dr. Jeffries, pathologist to the New York Polyclinic, and after decalcification by him sections were made which showed glandular carcinoma infiltrated with many calcareous pearls.

DERMATOLOGY.

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Epitheliomatosis of Solar Origin.—DUBREUILH (*Annales de dermat. et de syphilographie*, 1907, No 6), who has been studying the statistics of the Dermatological Clinic of Bordeaux with the view of ascertaining the effect of exposure to sunlight upon the occurrence of epithelioma, finds that senile keratoma, which is the first stage of epitheliomatosis, is observed with greatest frequency in those who live in the open air, and that in these it is only the exposed parts which are affected. Its regional distribution is determined not by anatomical conditions, but by the disposition of the clothing. The ears, frequently attacked in men, are entirely free in women who wear a handkerchief, or are affected only in those parts not covered by the handkerchief. Keratosis is not a purely senile alteration, since it may exist in children with xeroderma pigmentosum. Its occurrence is facilitated by age, which is the most important among the predisposing causes, but it is determined by the action of light. While insolation is the efficient determining cause of keratosis and epitheliomatosis, certain predisposing causes such as heredity and the structure of the skin, are not without influence. Dubreuilh concludes that senile epitheliomatosis of the face is not solely the result of old age; it is, above all the, result of chronic insolation and ought to be considered as closely related to chronic radiodermatitis. It affects particularly farmers and all those who work in the full sunlight. Blondes, whose skin contains but little pigment, seem to be more frequently attacked than brunettes, and much more frequently than individuals of the colored race. It is a disease essentially rural.

Cancer of the Mammary Gland Presenting the Clinical Picture of Paget's Disease.—KYRLE (*Archiv f. dermat. und syph.*, Band lxxxiii, Heft 2) reports a case of adenocarcinoma of the mammary gland which presented a typical picture of Paget's disease. The patient was a married woman, thirty-nine years old, who presented on the left breast, in the region of the nipple, a brownish-red, sharply circumscribed patch, about 6 cm. in diameter, covered with thin, yellowish scales. The surrounding non-ulcerated skin showed several radiating rhagades, while in the middle of the patch was a triangular, flat, circumscribed erosion, oozing in places, but covered for the most part by yellow crusts. The disease had lasted about eighteen months, and was believed by the patient to be due to an injury received from running against the corner of a table In addition to the external disease palpation revealed a walnut-sized lobed tumor in the depths of the mammary gland. Micro-

scopic study of the diseased areola and of the breast-tumor showed that, without doubt, the latter was the primary affection which, spreading in a retrograde direction through the nipple, gave rise to a secondary cancerous affection of the areola. The author believes that there is no uniform anatomicopathological substratum for Paget's disease, since at one time a squamous-celled, at another a cylindrical-celled or gland cancer may produce the picture of this disease, the flat epithelium of the areola, the epithelium lining the milk ducts, or the parenchyma of the milk glands furnishing the matrix for the carcinoma.

Epithelioma Adenoides Cysticum.—CSILLAG (*Archiv f. Derm. und Syph.*, Band lxxx, Heft 2), from a study of two cases observed in a mother and daughter, concludes that the little tumors of epithelioma adenoides cysticum are composed of undifferentiated embryonal epithelial cells, and have their origin partly immediately from the epidermis and partly from the external root sheath of the hair follicle. The cysts which are found in the tumors are of two kinds: (*a*) small cysts which arise from colloid degeneration of the tumor cells, and (*b*) large retention cysts resulting from the snaring off of the follicles and sebaceous glands. The milium-like structures seen in the tumors correspond microscopically to the retention cysts of the follicles and sebaceous glands.

The Bacillary Etiology of Folliculitis.—LEINER and SPIELER (*Archiv. f. Derm. und Syph.*, Band lxxxi, Heft 2 u.3), removing lesions with the sharp curette from two cases of folliculitis following measles and scarlatina, respectively, rubbed them up with sterile bouillon and injected the emulsion thus made into sound guinea-pigs, partly subcutaneously and partly into the peritoneal cavity. In animals thus injected tuberculous lesions were found from one week to two months later in several of the viscera and lymphatic glands, tubercle bacilli being demonstrable in such lesions. The authors conclude that these experiments establish the bacillary origin of folliculitis.

The Therapy of Lichen Ruber Planus.—VORNER (*Archiv f. Derm. und Syph.*, Band lxxxii, Heft 3) finds protective bandages and ointments as recommended by Seifert in the treatment of lichen ruber planus useful, but does not believe that the benefit following their use arises from the protection of the skin against external injury. In those cases in which localized patches remain after the internal use of arsenic the author has successfully employed this drug externally as a 0.5 per cent. ointment. In cases in which the disease is limited to the legs the use of bandages and arsenical ointment alone may be sufficient to effect a cure. The therapeutic results following the use of bandages upon the legs in lichen of this region are due, according to Vörner, to support of the veins, and not to the protection which they afford against injury.

A Fatal Case of Acute Lupus Erythematosus.—SHORT (*Brit. Jour. Dermat.*, August, 1907) reports a fatal case of erythematous lupus. The patient was a woman, aged twenty-eight years, who had been ill about four months before coming under observation, the first evidence of the disease being noticed upon the tips of the fingers and toes and on the

lobules of the ears. Upon her admission to the hospital there was diffuse swelling of the bridge of the nose and a red patch on the left cheek over the malar region whose surface was rough and dry. The finger tips and some of the toes were red and desquamating. A week later blebs containing pus appeared on a finger and a toe; and two weeks after, the eruption on the left cheek became worse, and a similar patch appeared on the right cheek and in the eyebrows. Follicular ulcers appeared on the roof of the mouth, the feet and vulva became edematous, and the lymphatic glands generally became hard and tender. About five weeks after admission to the hospital the patient had a general convulsion followed by unconsciousness and vomiting; this was followed by a short period of improvement, when vomiting began again, with frequent twitchings and convulsions. The eruption occupied the greater part of the face at this time, which was greatly swollen, but the trunk and limbs remained free except for two small slightly scaly patches at the point of the left elbow. Pneumonia now developed, and the patient died eight weeks after her admission. Microscopic examination of the skin of the face and of the toes showed a well-marked hyperkeratosis of the gland ducts. The fibers of the cutis appeared to be undergoing degenerative changes, as shown by a loss of characteristic staining reaction. Clumps of lymphocytes and fibroblasts were found with numerous plasma cells. Polymorphonuclears were not numerous.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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The Influence of the Antiferment of the Blood upon the Proteolytic Leukocytic Ferment.—It has been shown by Müller and Jochmann (and by Opie too, in this country) that when fresh blood serum or blood plasma is added either to leukocytes of the blood or of inflammatory exudates, that these cells lose their power of digesting coagulated proteids, while leukocytes washed free of blood serum possess in a marked degree this proteolytic action when brought in contact with coagulated serum at 37° C. or 50° C. WIEN (*Deut. Arch. f. klin. Med.*, 1907, lixi, 456), by using the method adopted by Jochmann and Müller, has tested the antileukoproteolytic action of the blood serum in 72 cases, which include various acute and chronic diseases. Löffler's blood serum coagulated in Petrie dishes served as the medium. Upon these plates is mixed 1 oese of pus and 1, 2, 3, 4, etc., oese of diluted blood serum. The degree and inhibition of proteolysis was measured by the cupping or lack of cupping of the surface of the blood serum. It was found that

with normal serum 5 oese diluted 1 to 5 with water was sufficient to inhibit the action of 1 oese of pus. In many conditions the antiferment action of the serum was not altered, but in cases of acute infections in which there was marked leukocytosis with evidence of destruction of the leukocytes the antiferment action of the serum was decreased. In one case of pneumonia Wien confirms Bittorf's work, and finds the antiferment action greatly reduced at the crisis, and increased to normal or a little above normal immediately after the attack. In uncomplicated tuberculosis the antiferment action of the blood serum was constantly increased. Wien considers that when there is an excessive destruction of leukocytes in the body the antiferment is bound by the degenerating leukocytes, and therefore the amount is decreased in the serum.

The Serum Diagnosis of Syphilis.—Since the original observations of Wassermann upon the diversion of the complement by the mixture of the serum from a syphilitic and an emulsion of organs infected with syphilis, the serum diagnosis of syphilis has assumed a practical value. It was soon found that an alcoholic extract of syphilitic liver acted as well as an emulsion, while later Landsteiner showed that an alcoholic extract of normal liver was quite as efficient as the extract of a syphilitic organ. It was finally discovered that the substance in the liver upon which this reaction was dependent was lecithin. Porges, working along these lines of investigation, pointed out the fact that when lecithin was brought in contact with the serum from a syphilitic patient a precipitate appeared after an interval of twenty hours. This reaction seemed to be specific for the serum of syphilitics. The method which he described was quite simple. Equal volumes of blood serum (0.2 c.c.) and a lecithin suspension in physiological salt solution containing 0.5 per cent. carbolic acid were mixed and allowed to stand for twenty hours. A positive reaction at the end of this time consisted in the formation of a precipitate in the tube. KLAUSNER (*Wien. klin. Woch.*, 1908, xxi, 214), while testing the efficiency of this reaction, discovered that if 0.2 c.c. of the blood serum of a syphilitic was mixed simply with 0.7 c.c. of distilled water, a flocculent precipitate formed at the bottom of the tube after an interval of one to fifteen hours. This precipitate measured from 2 to 4 mm. in height. It was considered to be globulin. With the serum from thirty-one syphilitics the reaction was performed fifty times without a negative result. With 23 control sera the reaction was obtained twice, once in a case of typhoid fever and once in a case of pneumonia.

NOBL (*Wien. klin. Woch.*, 1908, xxi, 287) reports the results of his investigations concerning the accuracy of both the methods of Porges and of Klausner. The reaction of Porges was tried in 83 cases of syphilis. The serum from 68 of these gave a positive result. Of the 68 cases, 36 had manifest symptoms of syphilis, although the duration of the disease varied from a few weeks to many years. In 32 cases there were no evident symptoms of syphilis when the blood serum was tested. Of the 15 patients from whom the serum gave a negative reaction, 8 were in a period of latency, while 7 had recurrent exanthemata or localized gummatous changes. Of the total number of syphilitics, the blood serum gave the precipitation phenomenon in 81.8 per cent.

This percentage of positive results compares very favorably with those obtained by the more elaborate method of complement diversion. By the latter method the highest percentages of positive reactions that have been reported vary between 80 per cent. and 84 per cent. With the Klausner method the precipitate was not obtained with such constancy. It was present in but 21 of 38 cases of known syphilis or in 55 per cent. of the cases. To compare the two methods more accurately, specimens of blood serum from 28 cases of syphilis were mixed at the same time with the lecithin suspension and with distilled water. In every case the method of Porges gave a positive result, whereas in 12 cases the method of Klausner failed. Nobl concludes that this simple method devised by Porges promises to be of great assistance and importance in the diagnosis of syphilis.

The Fermentation of Glucosides by Bacteria of the Typhoid-Colon Group and the Acquisition of new Properties of Fermentation by such Bacteria.—Twort (*Cent. f. Bakt. und Parasitenk*, 1907, xl, 508) has studied the fermentation reactions of 44 strains and varieties of bacteria of the typhoid colon groups upon 49 different glucosides. Of these 49 glucosides, 27 were acted upon by at least one of the bacteria used; but very marked variations were found between fermentative properties of the single members of the subgroups, which, in most instances, were as striking as the variations between the subgroups themselves. Probably the most important part of the work was the demonstration of an artificial variation in the properties of a single strain of bacteria to ferment sugars. By growing, through several generations, one bacterium in a 2 per cent. solution of a sugar, which at first it would not attack, the organism gradually acquired artifically the power of fermenting this sugar. Thus, it was possible to obtain strains of Bacillus typhous which fermented dulcit and lactose. By this process it was possible so to alter, in a comparatively short time, the cultural characteristics of certain pathogenic bacteria that they were scarcely recognizable. Such experiments demonstrate the difficulty of recognizing typhoid bacilli which have been recovered from water or sewage, in which perhaps for many generations they have lived under saprophytic conditions. Twort also suggests that if pathogenic bacteria may assume at least some of the characteristics of nearly allied saprophytic strains when cultivated outside the body, non-pathogenic bacteria may lose some of their saprophytic properties when introduced into the body, perhaps the intestinal canal, and assume pathogenic properties.

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